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AIR FORCE FLIGHT STANDARDS AGENCY  
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**AT-E-16**

## **AIR TRAFFIC CONTROL TRAINING SERIES**



### **EQUIPMENT**

**FLIGHT DATA SYSTEM II (FDS II)  
OPERATOR'S MANUAL**

**1 March 1997**

**FOREWORD**

**PURPOSE:** This publication is for the use in the training of USAF air traffic controllers and is not intended to replace, substitute for, or supersede official regulations, procedures, or directives.

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# 1. Preparing for FDS II

## 1.1 Things You Need To Know Before Powering Up The Computer!

### 1.1.1 Minimum Hardware Requirements & Operational Parameters

1.1.1.1 The following is a list of the minimum hardware requirements and operational parameters for the operation of the FDS II software (see FIGURE A. below):

- IBM AT compatible system based on an 80286 microprocessor chip (the Zenith Z-248 from the Air Force's Desktop II Small Computer Requirements Contract) with NO hard drive physically and/or logically connected.
- 512K bytes of RAM.
- One 5.25 inch double sided, double density (dsdd) floppy disk drive.
- A monochrome CRT.
- Modem communications shall be established and maintained through a n 8274 MPSC chip from Intel and other chip manufacturers (located on the "COM3" board in the Z-248).
- The FDIO peripheral devices (CRTs, RANKs, and RFSPs) shall interface with the FDS II via RS-422 (balanced) communication lines at 9600 baud. Interface to a maximum of sixteen (16) peripherals is provided by a pair of OC-8000 or Plus 8 multiport I/O boards from StarGate Technologies, Inc. Each of these boards is equipped with eight (8) 8250 UART chips made by National Semiconductor Corp.
- The software requirements for operation include MS-DOS 3.0 to 3.3 and current FDS II software.
- INTERNAL INTERFACE: the only interface used by FDS II is the StarGate OC8000 or Plus 8 Multi-I/O Board. **NOTE: Do NOT mix their components together.** This interface required to communicate with the local peripherals and may allow up to eight peripheral connections at one time. FDS II will accommodate two StarGate Boards for a total allowance of 16 peripherals. This interface is described in detail in the StarGate OC8000 or Plus 8 Instruction Manual. Also, disable your Zenith 248's hard drive through its CMOS/hardware setup program. FDS will not load unless the hard drive is at least logically disconnected in the CMOS.
- DESIGN CONSTRAINTS: the minimum number of peripherals required for the FDS II operation is three (3), consisting of one (1) RANK, one (1) CRT, and one (1) RFSP.
- PREPARATION FOR DELIVERY: the FDS II software shall be kept under configuration guidelines as dictated by HQ ESC/TG OL-D/E/3S support personnel.

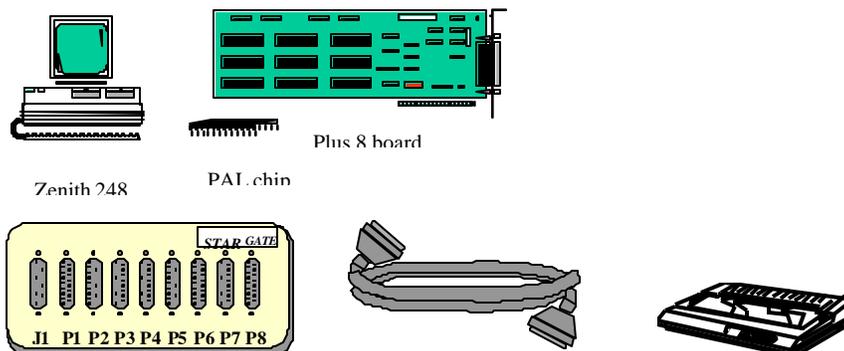


FIGURE A. Basic FDS II system components

- **NOTE:** When you first received the Star Gate card, it'll have a factory installed PAL chip. Replace it with the second PAL chip it came with. This second PAL chip usually comes with your Star Gate card. FDS software will NOT load properly with the factory installed PAL chip.

· **PLUS 8 Components Part Numbers:**

P8A8B1 Circuit Board  
 800003 PAL Chip---Rev. 2  
 P8A101 Panel/Cable

1.1.1.2 There is a one year Limited Warranty included with any new purchase of the items above. This warranty may be extended for an additional four (4) years (for a total of five (5) years) subject to all the terms and conditions of the original Limited Warranty. **IMPORTANT:** Fill out the "Warranty Registration Card" within (30) days of your date of purchase. A copy of the Warranty is located in each Star Gate Users Guide. If for any reason you fail to mail this warranty card within that 30 day period, simply call the company and request that extension over the phone. Most of the time, Star Gate customer service are lenient enough to do that for their customers.

1.1.1.3 For customer assistance, please call 1-800-STAR GATE (1-800-782-7428) or (216) 425-0723 from 8AM to 6PM, Eastern Standard Time. Technical Support hours are from 730AM to 7PM E.S.T. for your convenience.

1.1.1.4 Other numbers at Star Gate that may prove useful to you are as follows:

BBS Number ---- (612) 912-4800  
 Fax Number ---- (216) 963-4745  
 Main Switchboard Number ---- (216) 425-0723

· **Repackaging and Unpacking**

1.1.1.5 The PC and it's external components will be packaged in it's original shipping containers. The procedure to pack them is as follows:

- a. All packing cartons are opened at the top. All packing materials will be removed.
- b. If possible, pack the Keyboard by wrapping it in anti-static bag. Fold over end and tape to seal. Carefully place the keyboard into the container. Fold over flaps at top of container and seal with shipping tape.
- c. Pack the Monitor in anti-static bag (if available). Fold over end and tape to seal. Place the foam end caps at each side of the monitor. Carefully place the monitor into it's container. Fold over flaps at top of container (large flaps last) and seal with shipping strength tape.
- d. Pack the PC in anti-static bag. Fold over end and tape to seal. Carefully place the PC into the container. Fold over flaps at top of container (large flaps last) and seal with shipping strength tape.

1.1.1.6 The PC and it's external components are unpacked in the reverse order. Care should be used in cutting the top edge of the box not to exceed ¼-inch depth with the cutting edge. Packing materials should be stored inside the box and the box stored in a dry area in case it is ever necessary to transport the PC and it's external components.

---

**1.1.2 What is FDS II?**

1.1.2.1 The FDS II system acts as an intermediary distribution system between an ARTCC NAS computer and data display/input devices installed at terminal air traffic control facilities. The FDS II replaces the FDS I system without altering the standard operating routine of either system. Only minor alterations to data input techniques familiar to the previous systems have been included. These alterations compliment the FDS II system, enabling the system operator to communicate faster and more efficiently with the ARTCC NAS computer.

1.1.2.2 The Z-248 microcomputer, monochrome computer monitor and StarGate OC-8000 or PLUS 8 multichannel expansion board make up the main components of the FDS II systems control hardware group. Also, an ALPS dot matrix printer may be installed with the system. This system receives input from the NAS computer located in the FAA center and prepares the information prior to output to the peripheral devices located in the air traffic control facility.

**WAIT! *don't power up, yet!***

## 1.2 Let's Examine the Computer First

**1.2.1 Z248 Back Panel/Connections** (see Chapter 6 for detailed Z248 System Overview)--  
*suggestion: you will find your computer system easiest to use if all the components are located in the same general area. A good, solid work surface near a power source and a telephone and good lighting will prove best!*

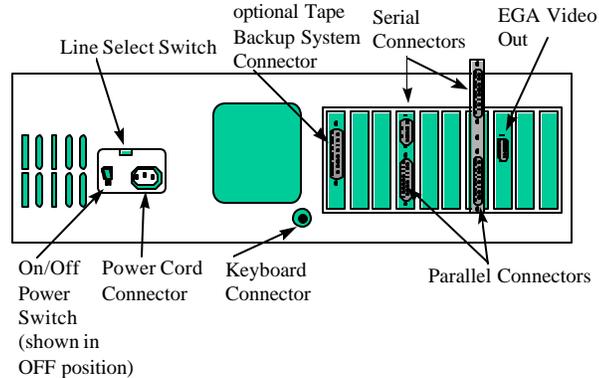


FIGURE B. The Z-248 Back Panel

1.2.1.1 The Back Panel Components (as shown in the FIGURE above)

- **Line Select Switch** -- This switch is used to select between 115 VAC and 230 VAC. You should never use this switch unless, during initial setup, you are in an area serviced by 230 VAC power source. (Check your electrical codes.) Changing the setting on this switch should be done only by qualified individuals. When the line voltage is changed, for example, 115 VAC to 230 VAC, the line cord plug must be changed to the proper type and voltage rating.
- **On/Off Switch** -- The power switch is located on the left side of the back panel. Make sure the switch is in the OFF position before you plug your computer into an outlet.

- Keyboard Connector -- a 5-pin “DIN” connector provides the necessary signals for connection with the computer keyboard.
- Serial Connectors – The necessary EIA-standard RS-232 signals for connection to a serial printer or other serial device are provided through these connectors. A special cable is needed to connect a DB-25 output to this connector.
- Parallel Connector – Provides the necessary parallel signals for connection to a Wespercorp/Eagle ES100 - type printer or other parallel out device.
- Video Out -- A 9 - pin connector that provides the necessary signals for a high-resolution color, enhanced color or monochrome monitor. The video card is supplied in your computer may also have a 15-pin connector that provides the necessary signals for a 480-line analog color or monochrome monitor.
- Tape Backup System Connector (not applicable to FDS II) -- this 37-pin connector provides the necessary signals for connection with an optional tape backup system.

**1.2.2 Control Key Combinations You Can Use**

1.2.2.1 Depending on which control key combinations will determine which function your Z-248 will execute. TABLE E. “Control Key Combinations” shows all control key combinations and their functions.

**1.2.2.2 Control Key Combinations**

TABLE E. Control Key Combinations

COMBINATION	FUNCTIONS
CTRL-S	When pressed, this key combination will cause any output to pause on the screen until any key is pressed.
CTRL-NUM LOCK	This key sequence will cause the computer to halt until any other key is typed.
CTRL-SCROLL LOCK	If this key combination is pressed, any MFM-200 command that is executing will be terminated and control will return to the MFM-200 monitor.
CTRL-C	same as CTRL-SCROLL LOCK.
CTRL-ALT-DEL	This three-key combination will cause the computer to act as though it was just turned on. Diagnostics will be performed and the system will be initialized.

**CTRL-ALT-INS**

This sequence acts the same as CTRL-ALT-DEL, except that the machine does not actually reset, but rather, control is forced to the system monitor. Since a reset is not performed, the machine does not autoboot. This permits users to boot from an alternate drive even though the setup menu is set for autoboot.

**CTRL-ALT-RETURN**

This three-key sequence is used to suspend a program (usually during the debugging process). It saves the contents of the CPU registers, and acts as though a user breakpoint has been executed. The user may then use the MFM-200 facilities to examine/modify the CPU registers, I/O ports, or the contents of memory. To begin executing again where the processor left off, the MFM-200 'G' command is used (without specifying the '=<addr>')

**ALT-ESC**

When used with a Zenith keyboard, this toggles the key click. This means that pressing the keys will turn the key click on if it is off, and vice versa.

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## 1.2.3 How To Adjust the Keyboard

1.2.3.1 The keyboard of your computer has an adjustment that allows you to select one of two positions of tilt. A leg is located under each back corner of the keyboard. (see FIGURE C. below)

- To increase the tilt of the keyboard, refer to the inset in the figure and press each leg on the spot indicated.
- To select closed position, move each leg back into its closed position.

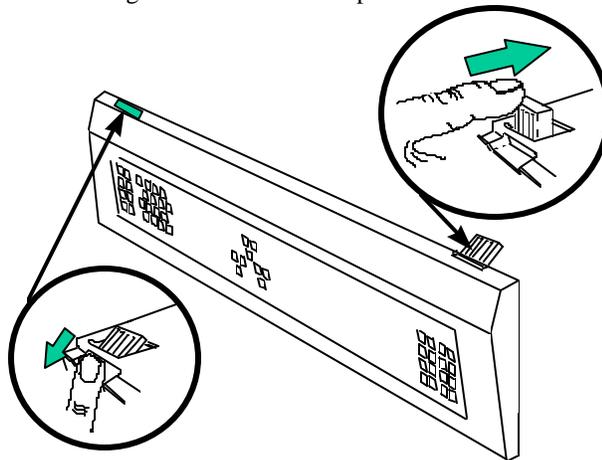


FIGURE C. Keyboard Adjustment

## 1.3 Powering Up the Computer

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### 1.3.1 Before Powering Up!

#### ***BEFORE POWERING UP!***

1.3.1.1 **CAUTION:** This computer system is designed to operate on either of two different AC line voltages, either 115 VAC at 60 Hz or 230 VAC at 50 Hz. Before connecting the computer, make sure it is rated for the voltage available in your area. The computer is set at the factory for 120 volts, the standard voltage in the United States. To change the voltage rating, contact your authorized repair facility.

\*\*\*\* Before you connect any of your computer's components to an AC power source, turn all power on/off switches off.

The computer has a detachable power cord. Plug the appropriate end of the power cord into the computer. Do not attach the other end at this time.

1.3.1.2 With multiple power cords involved, you may want to use a switched multiple outlet box or power strip to turn on (or off) all system components at the same time. If you do use a switched outlet box or power strip, make sure it is properly rated for your system's power needs (for 115 volt systems, 10 amperes; for 230 volts, 5 amperes).

1.3.1.3 **Do not** use an extension cord unless it is a heavy-duty, three-wire type. Smaller cords tend to reduce the amount of voltage available and can cause unsatisfactory performance from your computer.

1.3.1.4 Position the computer so the front is clear and you can insert or remove disks as needed. You also should be able to easily reach the power on/off switch on the back panel. Plug the power cord into an AC power source.

1.3.1.5 The monitor may be placed on the computer or anywhere convenient. Plug its power cord into an AC power source.

1.3.1.6 Place the keyboard where you will normally use it. It receives power directly from the computer and does not have a separate power connection.

1.3.1.7 Place any other peripherals you may be using in their operating positions and plug their power cords into an AC power source.

---

### 1.3.2 What's a Normal Power Up and What's Not

1.3.2.1 The computer system's power may be turned on in any sequence; however, **never** turn your system's power on or off with a disk in the floppy disk drive; remove the disk first. Powering ON with a disk in the floppy disk drive will MOST likely erase everything on that disk!!

1.3.2.2 There are two suggested sequences for turning on your system:

- One switch operation through a switched multiple outlet power box or strip. The one switch on the box or strip will control the entire computer system simultaneously.
- For most applications, apply power to your monitor first, then the computer. Finally, turn on any other peripherals attached to your computer system.

1.3.2.3 After the system is turned on, a number of things will happen: a small, quiet fan will start; a light on the disk drive will come on; and the drive will make some sound as the “read/write heads” move back and forth. Factory assembled computers are set to “autoboot” (automatically load a disk operating system (DOS) from a floppy) when they are shipped. One of the lights on the disk drives will come on and remain on in a computer set for autoboot. If autoboot is started, a disk must be placed in the drive and the door shut within about 20 seconds.

1.3.2.4 If you want to reset the system by turning it off and then on again, wait at least five seconds before turning the computer on.

---

### 1.3.3 Self-Tests

1.3.3.1 When you turn on your computer, it executes a series of internal tests to check that everything is working correctly. These tests serve several important functions. First, they verify that all of the circuits are in a starting configuration. Second, the tests check various functions of the computer so it will operate properly.

1.3.3.2 When the tests are finished, the computer will let you know it is ready to run by displaying the opening message, or starting the automatic boot procedure (autoboot).

1.3.3.3 If some portion of the equipment fails to operate correctly, the computer will attempt to display an error message.

---

### 1.3.4 Loading the Disk Operating System (MS-DOS 3.2)

1.3.4.1 A Disk Operating System (DOS) is a program that lets you do certain tasks, such as organize the disk (with the FORMAT command), copy information from one disk to another (with the COPY command), enter date and time (DATE and TIME commands), and load other programs.

1.3.4.2 MS-DOS was prepared for the Zenith Data Systems Z-200 PC Series Computers by Microsoft. It is supplied on disks and must be loaded into your computer.

1.3.4.3 SETUP.EXE (not to be confused with the CMOS SETUP or SETUP program—invoked by either hitting CTL-ALT-ENTER or CTL-ALT-INSERT) is a menu driven utility (located in disk #1) that can be used to make working copies of your MS-DOS distribution disks. SETUP.EXE can also be used to do two things: (1) make “working disks.” These are disks that contain system files so you can boot up from the disk without loading MS-DOS separately, and (2) initialize the Hard Drive.

1.3.4.4 SETUP.EXE will also set up a Winchester partition on a hard drive. It will format the partition, transfer the system files, set up a BIN (Zenith’s version of a DOS subdirectory), transfer the utility files to the subdirectory and establish a path to it.

## Loading the Disk Operating System

1.3.4.5 The following steps will show you how to load the DOS for the first time and then create backups, or working copies, of the distribution disks.

1.3.4.6 To load MS-DOS:

1. Turn on the computer, or press the CTRL, ALT, and DEL keys in sequence while holding down each of the previous keys if the computer is already on. NOTE: If your computer is equipped with a Winchester drive, press the CTRL, ALT, and INS keys.
2. Insert MS-DOS Disk 1 into drive A.
3. Close the disk door or latch.
4. If you are booting the computer manually, press in sequence the B, F, and 0 (zero) keys. The computer will display:

```
bf0
```

5. Press the RETURN key.

1.3.4.7 The disk access light will come on, indicating that the disk is being read by the computer. You may hear a buzz or two from your drive, which is the normal sound of the disk drive motors.

1.3.4.8 As MS-DOS is read into the computer, your display will show messages similar to the following:

```
MS-DOS Version 3.XX
© Copyright Microsoft Corp. 1981, 82, 83
Current date is Tue 1-01-1980
Enter new date (mm-dd-yy):
```

1.3.4.9 The date actually shown by your computer will probably differ from this display. The format for entering the date is M/D/Y or M-D-Y, where M is the month (1 to 12), D is the day (1 to 31), and Y is the year (80 to 99). Four digits may be used for the year. Any other response will cause them the computer to display:

```
Invalid date
Enter new date (mm-dd-yy):
```

\*\* Enter the current date and press the RETURN key. The computer will display:

```
Current time is 0:03:20.20
Enter new time:
```

1.3.4.10 The time actually shown by your computer will probably differ from this display. You will use the format H:M:S.C to enter the time, where H is hours (0 to 23), M is minutes (0 to 59), S is seconds (0 to 59), and C is tenths of a second (0 to 9). Minutes, seconds, and tenths of a second are optional and may be omitted. The separators, colon and period, must be used exactly as shown or else the following error messages will be displayed:

```
Invalid time
Enter new time:
```

\*\* Enter the current time and press the RETURN key. The display will now show:

```
A>
```

1.3.4.11 You can see by the sample display that the arrow has been replaced by A> which the prompt used by MS-DOS. This display also tells you which drive is currently being used by the system, called default drive.

\*\* When the MS-DOS prompt appears the computer will continue and will load and run the SETUP program.

\*\* Follow the instructions displayed on the screen to make backup copies of your DOS disks and then store original disk in a safe place.

1.3.4.12 Later on , you will find out how to change the drive being used. But first, you need to create a copy, or backup, of MS-DOS and store the original in a safe place.

---

## 1.3.5 How to Initialize Your Hard Drive

### 1.3.5.1 *What's a Hard Drive?*

1.3.5.1.1 The Hard Drive (or Winchester Disk), is an option that will allow you to store equivalent of several dozen floppy disks inside your computer, ready for immediate access in your daily business needs. Besides additional on-line capacity of stored records, the speed at which that information may be accessed is increased by a factor of ten or twenty.

1.3.5.1.2 The organization of an individual hard disk is similar to a floppy disk. However, a hard disk system may have more than one platter (disk), and the system may use each side of each platter. Therefore, each side will have its own read/write head. Each head is in alignment with the heads for the other platters or sides, and all are moved together.

1.3.5.1.3 A track is that portion of the disk that passes under a read/write head. If you have four read/write heads on four different platter sides, you will have four tracks that are passing under the heads at one time. These four tracks make a "cylinder." A cylinder has as many tracks as there are heads in any particular hard disk system.

1.3.5.1.4 In addition to being divided into cylinders, tracks, and sectors, a hard disk may be "partitioned." A partition is a group of tracks or cylinders that you use as a "logical" drive for particular application or operating system.

1.3.5.1.5 A logical drive acts like a floppy disk. Because a hard drive is considered to be a logical drive, it will be treated the same as an individual floppy disk drive. It will be uniquely identified with a drive name, such as C or D. It may contain an operating system such as MS-DOS, or may be used strictly for data storage.

1.3.5.1.6 The hard drive in your computer uses a single head per platter side, and is sealed against contamination from the outside. Before you can use it, the disk surfaces must be prepared (formatted like a floppy disk) and partitioned. Your operating system from Zenith Data Systems contains four utility programs: PART, PREP, SHIP, and DETECT that will be used to prepare and partition your system.

### 1.3.5.2 *Initializing the Hard Drive*

1.3.5.2.1 There are four partitions: one called DOS and three unallocated. You can use up to four partitions. Each partition will be treated like an individual disk. Therefore, it's possible to have different operating systems on different partitions. However, you may not have two different operating systems on the same partition.

1.3.5.2.2 The first of the four partitions that exists on your hard drive occupies the total hard disk space. It has been assigned a distinct name: DOS. This can represent any of the popular operating systems compatible for this system. If this one partition will need your needs, proceed to establishing the Default Boot Partition.

1.3.5.2.3 First you will use one section of PART to establish the default boot partition for the operating system. Then you will install MS-DOS.

#### 1.3.5.2.4 ESTABLISHING THE DEFAULT BOOT PARTITION

- Use your MS-DOS disk and run PART.
- Press the **F1** key to establish the default boot partition.
- Press the **1** key to select DOS (for the MS-DOS operating system) as the default system to be used when booting from the Hard Drive.
- Press the **E** key to quit PART, and the **M** to make changes and exit to the operating system.

NOTE: Before you attempt to install any operating system on your Winchester disk system, you must reset and reboot your system using the operating system you wish to install. If you wish to install MS-DOS, you will have to boot your system with MS-DOS SETUP disk.

- Turn on your computer (if it is not already on), place your MS-DOS SETUP disk in the floppy disk drive, and close the drive door.
- If your computer is not set up to autoboot from the floppy disk, press **B** key and then the **F** and **0** keys, followed by the **RETURN** key.

In a moment, the MS-DOS initial message will appear and you will be asked to enter the date and time. Enter them. The MS-DOS prompt will appear followed by the command SETUP. SETUP will then load and display its opening message on the screen.

- Follow the instructions on the screen for preparing a Winchester partition.

#### 1.3.5.2.5 ESTABLISHING MULTIPLE PARTITIONS

Your Hard Disk can be divided into as many as four partitions to accommodate different operating systems and files. There are three basic steps for preparing a Winchester for use with multiple partitions after allocating space to the partitions through the PART utility.

- DSKSETUP – The DSKSETUP utility must be run to change automatic partition assignment to manual partition assignment.
- ASGNPART – Although the boot partition is accessible as soon as you boot from the Hard Disk, no other partition can be accessed until you run the ASGNPART utility. Use this utility to assign letter values to each of the partitions created when the PART utility was run.
- FORMAT – Each partition must be formatted before use.

#### 1.3.5.2.6 BOOTING FROM THE HARD DRIVE

**NOTE:** This boot procedure assumes that you have assigned the DOS partition as the default boot partition.

At this point, you may boot your computer from the Winchester disk. Use the same procedure to boot your computer as you would if you were using a floppy disk. The only difference is that the Winchester cannot be removed from the system, and so it is ready to go when you turn on or reset your computer.

If your computer is not set up to boot from the Hard Disk, press the B key and then the W key, followed by the RETURN key. The Hard Disk access light will come on along with the MS-DOS opening message. You may now use any MS-DOS program or utility you want.

---

### 1.3.6 More on Hard Drives

1.3.6.1 If you need to update the SETUP program information and need to determine the drive type for a factory-installed drive, you can identify the drive type by a code on the back panel of the computer. This code is arranged in 3-digit sets, each representing one drive.

- The first 3-digit set represents the drive type identifier code for floppy drive A.
- The second 3-digit set represents the drive type identifier code for either floppy drive B (if present) or Winchester drive 0.
- The third 3-digit set represents the drive type identifier code for either Winchester drive 0 or Winchester drive 1, depending on whether floppy drive B is installed.
- The fourth 3-digit set represents the drive type identifier code for Winchester drive 1. The maximum of 12 digits indicates that four drives are installed in the computer.

See TABLE B. Winchester Drive Types

1.3.6.2 To enter a drive type number, use the space bar and BACK SPACE key. Scan through the drive types (1 through 43) until you find one that matches the data for your drive.

1.3.6.3 A system without a Winchester drive has NOT PRESENT entry in the CMOS SETUP Program.

TABLE B. Winchester Drive Types

DRIVE TYPE	Capacity (Bytes)	CYL	HEADS	PRECOMP	SHIPPING ZONE
1	10M	306	4	128	305
2	20M	615	4	300	615
3	29M	699	5	256	710
4	62M	940	8	512	940
5	46M	940	6	512	940
6	20M	615	4	Off	615
7	40M	699	7	256	710
8	30M	733	5	Off	733
9	112M	900	15	Off	901
10	38M	925	5	0	926
11	35M	855	5	Off	855
12	49M	855	7	Off	855

13	20M	306	8	128	319
14	42M	733	7	Off	733
15	21M	612	4	0	663
16	42M	977	5	300	977
17	59M	977	7	Off	977
18	62M	1024	7	512	1023
19	31M	733	5	300	732
20	44M	733	7	300	733
21	31M	733	5	300	733
22	10M	306	4	0	336
23	10M	612	2	Off	611*
24	32M	615	6	300	615
25	32M	462	8	256	511
26	21M	820	3	Off	820
27	59M	981	7	Off	986
28	72M	754	11	Off	754
29	119M	918	15	Off	919
30	42M	987	5	Off	987
31	43M	830	6	400	830
32	24M	697	4	300	696
33	21M	615	4	300	615
34	21M	615	4	128	663
35	80M	1024	9	Off	1024
36	44M	1024	5	512	1024
37	42M	820	6	Off	910
38	21M	615	4	306	684
39	72M	925	9	0	926
40	71M	1024	8	512	1026
41	44M	1024	5	Off	1026
42	42M	615	8	300	615
43	43M	989	5	0	990

\* Cartridge media

## 1.4 Setting Up the Computer's CMOS or System Configuration—A Must!

### 1.4.1 SETUP Program

1.4.1.1 The SETUP program serves as a reference, giving the computer information about your system's configuration. The information you enter about your system is kept in memory for all future uses and can easily be changed if you alter your configuration.

1.4.1.2 Press **CTRL** and **ALT** keys simultaneously and while holding them down, press the **INS** key to get to the system prompt (→). Type **SETUP** after the MFM-200 system prompt (→) and press the **RETURN** key to run the program.

1.4.1.3 When the setup screen first appears, the standard selection in each field, or grouping, is already highlighted on the screen with a rectangular-shaped, reverse-screen image. You can make your own selections by highlighting the data which matches your system's configuration.

1.4.1.3 You can move up, down, left, or right between fields using the arrow keys. Within each field, except the time and the date field, use the space bar and BACK SPACE key to move between entries.

1.4.1.4 To make a selection, move to the desired field and highlight the entry that describes your system. This selection will be locked in when you move to the next field.

1.4.1.5 The message area at the bottom of the screen will provide help and error messages.

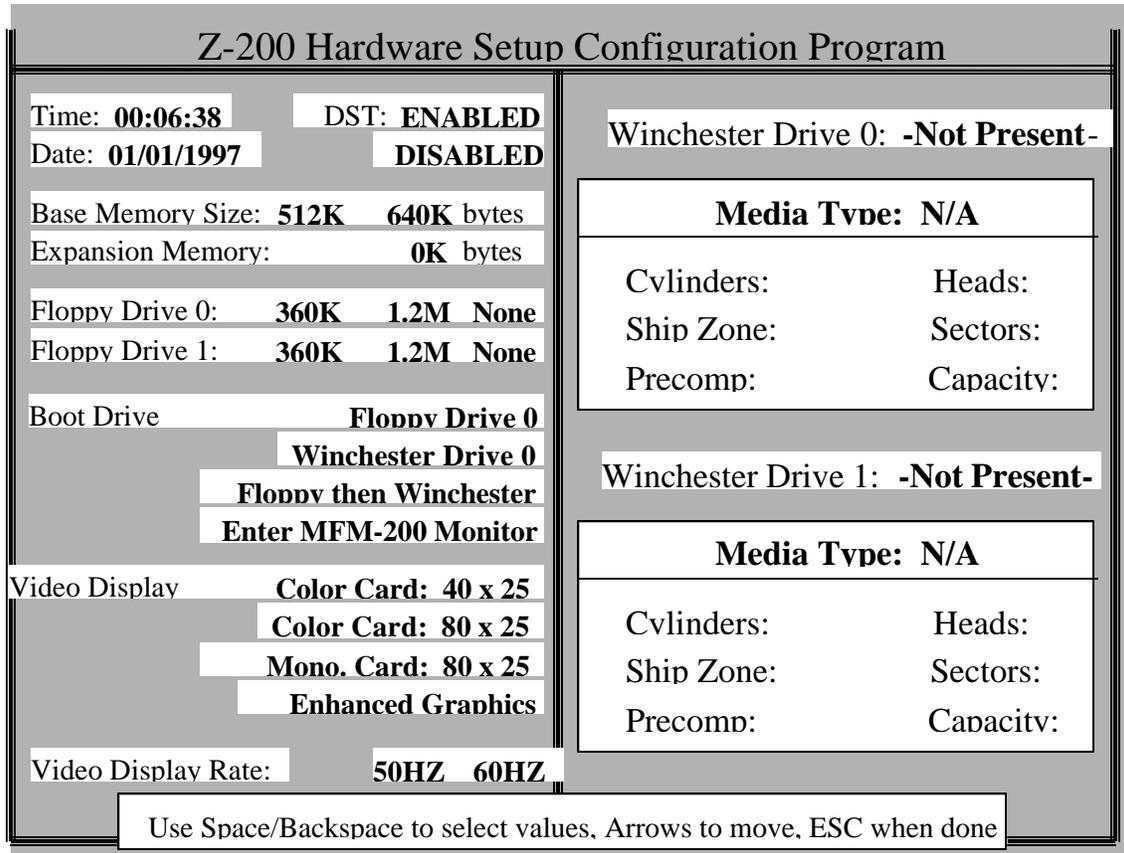


FIGURE D. Z-200 Hardware Setup Configuration Program

1.4.1.6 Pertinent fields in the above FIGURE are defined below:

**TIME**

1.4.1.6.1 The time and date are the only entries that need to be typed in. All the other data is selected using the highlighted cursor. The system's clock is battery-operated and will run continuously, even when the computer is turned off. Therefore, you do not need to enter a new time and date each time you turn the system on. The time must be entered in a two-digit format. For example, the hour entry for 9 a.m. is 09. It is not necessary to enter the colons between the hours, minutes, and seconds. They will be entered automatically.

Example: 4:35 a.m. is entered as 043500

4:35 p.m. is entered as 163500

1.4.1.6.2 If the time is not entered correctly, an error message will appear at the bottom of the screen. The cursor will not move past the entry until a valid time is entered. If you make a mistake while typing, use the

BACK SPACE key to return to the position where you made the mistake and type over it. After entering the time, press the RETURN key to move to the date entry.

· **DATE**

1.4.1.6.3 The date entry format is mm/dd/yyyy, where mm represents the month, dd represents the day of the month, and yyyy represents the year. Note that the numbers representing the month and day consist of two digits, while the year is represented by a four-digit number.

Example: March 21, 1996 is entered as 03211986

1.4.1.6.4 It is not necessary to enter slashes between the month, day, and year. They will be entered automatically. After entering the date, press the RETURN key.

1.4.1.6.5 The time and date fields are the only ones which are entered using the RETURN key. In the remaining fields, your selection will be locked in when you move to a new field using the arrow keys.

· **DST**

1.4.1.6.6 The next field, to the right of the date and time, is labeled DST, which stands for Daylight Savings Time. If you are operating the system in an area where Daylight Savings Time is in effect at some time during the year, you will want to enable this feature. The clock will automatically be set backwards or forwards one hour on the correct day.

· **BASE MEMORY**

1.4.1.6.7 Select your computer's base memory size by positioning the highlighted cursor over 512K or 640K, using the space bar or the BACK SPACE key. The basic computer is shipped from the factory with 512K. Select the correct base memory size to avoid CMOS errors to appear after rebooting the system.

· **EXPANSION MEMORY**

1.4.1.6.8 If your computer contains more than maximum 640K of base memory, you need to select the number of bytes of expansion memory you have added to the system. The selection ranges from 0 to 15,360K increments of 64K. Use the space bar to make the number higher and the BACK SPACE key to choose a lower number. If you do not have any expansion memory, set the number at 0.

· **FLOPPY DRIVE 0**

1.4.1.6.9 If you are using one or more floppy disk drives, you need to choose between the 360K low-density drive, or the 1.2M high-density drive for each one that is present. Your first floppy drive is referred to as "FLOPPY DRIVE 0". If you do not have a floppy drive, choose NOT PRESENT.

· **FLOPPY DRIVE 1**

1.4.1.6.10 If you are using a second floppy disk drive, it is referred to as "FLOPPY DRIVE 1". Choose again between the 360K drive and the 1.2M drive formats. If you do not have a second floppy drive, choose NOT PRESENT.

· **BOOT DRIVE**

1.4.1.6.11 The Boot Drive field allows you to set your default drive, which is the drive the computer will autoboot first. Four options are available:

Option #1: The computer attempts to read the first floppy disk. (the FDS Option!)

Option #2: The computer attempts to read the first Winchester disk (or hard drive).

AVOID this option for 2 reasons:

1. you may not have a hard drive
2. FDS will NOT load with this option enabled

Option #3 (default): The computer attempts to read the first floppy disk and if a bootable disk is not found, continues on to the first Winchester disk (or hard drive).  
FDS will NOT load properly with this option.

Option #4: The computer enters the MFM-200 monitor. The system prompt (→) will appear and you can then boot from any drive using the boot ('B') command. For example, 'B0' or 'B1' respectively, floppy drive A or floppy drive B but NOT 'BW' (or Drive C.)

#### · VIDEO DISPLAY

1.4.1.6.12 If your system includes a color video card, select one of these options:

- Option #1: 40 x 25 for 40-character display
- Option #2: 80 x 25 for 80-character display
- Option #3: 80 x 25 for monochrome display
- Option #4: (default) Enhanced graphics card

1.4.1.6.13 If you have an optional high-resolution monochrome text display adapter installed and plan on using it as the default display, select the monochrome card.

#### · VIDEO REFRESH RATE

1.4.1.6.14 The video refresh rate should be set according to the power line frequency in your area. In the United States, the typical power line frequency is 60 Hz. If your system is not set correctly, the video screen will flicker.

#### · WINCHESTER DRIVES (NOT Necessary for FDS) -- should NOT be enabled if present or installed. FDS will not execute with a working hard drive.

1.4.1.6.15 The Winchester drive type (or Hard Drive) is entered in the SETUP program when Winchester drives are installed at the factory. You only need to enter the drive type if you add more Winchester disk drives to your system. Refer to Table B for the different drive types.

1.4.1.6.16 If you need to update the SETUP program information and need to determine the drive type for a factory-installed drive, you can identify the drive type by a code on the back panel of the computer. This code is arranged in 3-digit sets, each representing one drive.

- The first 3-digit set represents the drive type identifier code for floppy drive A.
- The second 3-digit set represents the drive type identifier code for either floppy drive B (if present) or Winchester drive 0.
- The third 3-digit set represents the drive type identifier code for either Winchester drive 0 or Winchester drive 1, depending on whether floppy drive B is installed.
- The fourth 3-digit set represents the drive type identifier code for Winchester drive 1. The maximum of 12 digits indicates that four drives are installed in the computer.

See TABLE B. Winchester Drive Types

1.4.1.6.17 To enter a drive type number, use the space bar and BACK SPACE key. Scan through the drive types (1 through 43) until you find one that matches the data for your drive.

1.4.1.6.18 A system without a Winchester drive has NOT PRESENT entry.

**1.5 In Case of Difficulty**

---

**1.5.1 Troubleshooting**

1.5.1.1 All Zenith Data System (ZDS) computer hardware and software products are designed to work together as a complete system. Proper operation can be assured only when your computer is used with ZDS designed or compatible accessories. It is your responsibility to ensure proper operation and interface to maintain your Zenith 248 system(s).

1.5.1.2 Table C below provides troubleshooting information for common initial setup problems.

**TABLE C. Troubleshooting Table**

System won't boot automatically	<p>Wrong disk ( you mush use a DOS system disk or your FDS Bootable disk.</p> <p>Disk is inserted wrong.</p> <p>Disk latch not closed.</p> <p>Autoboot not set internally in CMOS hardware configuration program, e.g., option 'boot drive: floppy drive 0'.</p> <p>Floppy Controller card not seated properly.</p>
System won't boot from opening messages	<p>Haven't pressed the RETURN key.</p> <p>Wrong disk (you are trying to boot from an unformatted disk or data disk.</p> <p>Disk inserted wrong.</p> <p>Disk latch not closed.</p> <p>Pressed the wrong key.</p>

---

Nothing happens at poweron, and the green light on the front panel in not lit

Line cord not plugged in (check both ends). If you are using multiple outlet box, check its plug.

Power not on at AC power source (wall outlet). Check with a different appliance.

Power switch not on (either the computer or the multiple outlet box).

Line select switch incorrect for your area

---

System resets to power-on point or disk keeps rebooting

Loose line cord.

Bad disk.

Cards not seated properly.

---

Error message displayed right after power on.

See section on “Initial Diagnostics”

---

Blank screen on the monitor.

External monitor not turned on.

External monitor not plugged in.

External monitor not properly connected to computer.

Brightness control turned down.

Computer not transmitting a signal (screen was blanked or cleared by the program).

NOTE: This will not be the case when you first turn on the unit or the computer is waiting for you to do something.

CPU failure during initial tests (see the Initial Diagnostics discussion).

Video card test seated properly.

---

Insufficient brightness

Brightness control on the monitor turned down.

---

## 1.5.2 Initial Diagnostics

1.5.2.1 Your Z-248 performs a series of self-tests whenever it is turned on. The computer beeps if it encounters any hardware failures during these tests.

1.5.2.2 If the computer fails any of the tests, it attempts to display an error message. Possible error messages along with their likely causes are listed below (Table 3).

---

**Table D. Possible Power-up Diagnostic Messages and Explanations.**

---

+++ ERROR: CPU failure! +++

+++ ERROR: ROM checksum failure! +++

If either of the above two messages appear, the CPU card is not functioning properly. The checksum message is a result of a mismatch between a predetermined value and a value derived from the contents of system ROM. Turn the computer off, wait five seconds, and then turn the computer on again.

---

+++ ERROR: RAM failure! Address: XXXX:YYYY, Bit: N, Chip: UXXX +++

+++ ERROR: Parity hardware failure! Address XXXX: YYYY, Chip: UXXX +++

+++ ERROR: RAM failure! Address: XXXX:YYYY, Chip: UXXX +++

These message indicate that the CPU is unable to read or write to the RAM or video RAM memory. If the chip number is displayed is a 200 number, the failure is on the CPU card. If the chip number is a 400 number, the failure is on the expansion card. Before replacing a card, check that the card is properly seated in the backplane slot.

---

+++ ERROR: Timer interrupt failure! +++

If this error occurs, the timing logic on the I/O card may have failed. Make sure that the card is properly seated and set up for the options installed. Also, check that all optional cards are set up correctly.

---

+++ ERROR: Keyboard not responding or not connected! +++

A message of this type indicates that the keyboard did not send the code at powerup to indicate proper functioning. The most likely cause is a disconnected keyboard. Check the cable to make sure it is connected.

---

+++ ERROR: Divide by zero! +++

+++ Overflow! +++

+++ Wild Interrupt! +++

+++ ERROR: Memory parity failure! +++

+++ Non-maskable interrupt! +++

Instructions or interrupts were generated by the computer or a peripheral causing this type of error. If any of these error messages occur, your computer will not work.

---

+++ ERROR: CMOS Memory Failure! +++

A memory test of the CMOS memory/clock chip on the I/O card indicates faulty memory within the chip. This error could be due to reinstallation of the I/O card. Try running SETUP again and turning the computer OFF and ON again.

---

+++ ERROR: System Control Processor failure! +++

The system control processor on the I/O card is not responding. This will affect the functioning of the keyboard as well as other vital system functions.

---

+++ ERROR: Please replace the back-up battery! +++

Replace the back-up battery that is used to keep the CMOS memory valid when power is not applied to the system. If the I/O had been removed simply rerun SETUP.

---

+++ ERROR: Bad configuration information found in CMOS! +++

The memory in the CMOS chip does not contain valid information. The system will automatically execute the SETUP command so the user may set up the CMOS correctly.

---

+++ ERROR: Base memory size error! SETUP: XXXK ACTUAL: XXXX +++  
 +++ ERROR: Expansion memory size error! SETUP: XXXXK ACTUAL: XXXXK +++

The amount of memory specified in the SETUP command does not equal the amount of memory actually found by the system. Faulty or non-existent memory, or invalid SETUP information may be the cause.

---

+++ DISK ERROR: Drive not ready! +++  
 +++ DISK ERROR: Seek failure! +++  
 +++ DISK ERROR: Cannot reset drive! +++  
 +++ DISK ERROR: Invalid data read! +++  
 +++ DISK ERROR: Data corrected! +++

These errors are usually caused when the system attempts to boot the operating system from a disk and no disk has been inserted into the disk drive. Be sure that there is a disk in the drive inserted correctly and the drive latch is closed properly. These errors also could be caused by the invalid SETUP information.

---

+++ DISK ERROR: Disk not bootable! +++

This error message indicates that the boot code read from sector 0 is not a valid executable code on the floppy disk. Try a backup disk with the operating system.

---

+++ DISK ERROR: Bad disk controller! +++  
 +++ DISK ERROR: DMA overrun error! +++

These errors usually indicate a faulty disk controller card but may be caused by other cards in the computer (game cards). Remove these additional cards and the run the tests again. If the problem no longer occurs, replace the cards one at a time; then run the test after each card has been inserted. When the system no longer functions, the last card placed in the system could be defective.

---

+++ DISK ERROR: Must run SETUP to boot from Winchester! +++

This error message is for Winchester only and indicates that an attempt was made to boot from a Winchester drive for which no SETUP information was specified. Run SETUP and specify a Winchester drive type for that drive.

---

+++ DISK ERROR: Sector not found! +++  
 +++ DISK ERROR: CRC error! +++  
 +++ DISK ERROR: Invalid address mark! +++

These errors happen when booting the operating system from disk. They can result from using a disk that does not have a copy of the operating system on it, or from a faulty disk drive. Most often, this condition can be corrected by using another disk. If these errors occur often, it may be necessary to have a technician align your drives and/or adjust the disk controller card.

---

**NO ERROR MESSAGE** -- Occasionally, a malfunction may occur that, by its nature, prevents anything, including an error message, from being echoed to the monitor screen. Check to make sure that you are allowing enough time (up to thirty seconds for Winchester systems) for any disk I/O problems to surface.

---

Whenever any of the error message in the table above is displayed, be sure the write it down in full. Your service technician or you will need this information later.

## 2. Putting All the Hardware Together

### 2.1 The Required Cards in Your Computer

#### 2.1.1 Cover Removal

1. Turn off the computer and unplug the line cord from the AC outlet.

**WARNING:** Hazardous voltages may be present inside the computer whenever the line cord is connected to an AC outlet. **Do not** begin disassembly before unplugging the unit.

2. If a monitor is connected to the computer, disconnect its cable and set the monitor aside. Also disconnect the cables of any other peripherals connected to the computer and set them aside.
3. Remove and save the screws that secure the top cover to the unit

4. Remove the cover by sliding the cover to the front while holding it up to avoid catching any wires, cables, or connectors. Set the cover aside. REFER to the Figure below.

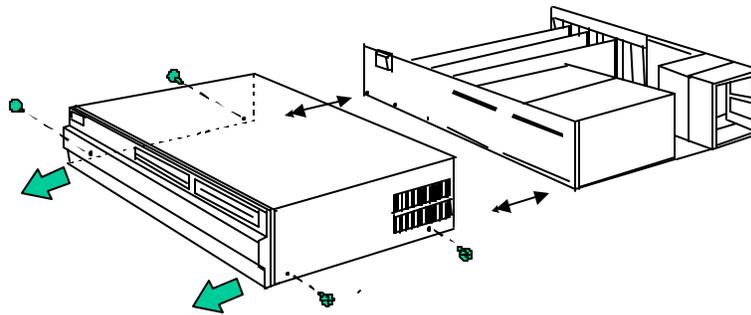


FIGURE F. Cover Replacement/Cover removal

## Cover Replacement

1. Push all of the cables down as far as possible.

**NOTE:** Make sure the cables going to J5 on the disk controller card (slot 1) and P301 on the I/O card (slot 4) are properly connected.

2. Slide the cover back onto the unit and secure it with the screws removed and set aside during cover removal.
3. Reattach the cables on the rear panel.

### 2.1.2 How to Remove or Install Any Card

## Card Removal

Before any cards may be removed, the cover must be taken off.

Disconnect any cables that may be attached to the card. Double check to make sure that you are removing the proper card.

Remove the support bracket screw securing the card in the computer

Firmly grasp the card to be removed with one hand toward the front and the other about midway down the card. Lift the card directly up with firm pressure. **Do not** jerk the card.

Place the card on a level, nonconducting surface with the components facing up.

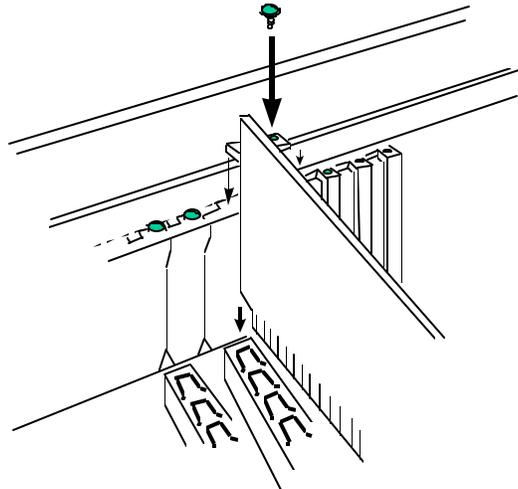


FIGURE G. Card Removal/Installation

## Card Installation

Grasp the card and position it over the backplane.

Make sure that the edge connector faces down and is aligned properly. Slowly and firmly push the card into the edge connector.

Secure the bracket of the card to the unit with the bracket screw. If necessary, reattach any cables.

Replace the cover.

---

### 2.1.3 Setting up the COMM 3 Card (the Serial/Parallel Card)

2.1.3.1 This card holds the modem connection you need for connecting with the NAS. This connection is possible via the serial port (or comm port) of the Parallel/Serial Adapter (or COMM 3 Adapter). The serial/parallel card is shipped preset for proper operation that includes jumper-selectable interrupt, and software-selectable duplex and baud rate. Unless notified, jumpers and switches should remain in the same position.

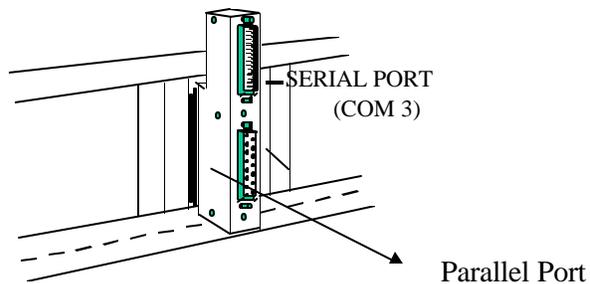


FIGURE 13. Parallel and Serial Connectors

2.1.3.2 Both the parallel and serial ports are located on the external breakout box mounted on the rear of the serial/parallel card, as shown in the figure above. The parallel port is the lower port on the breakout box and is a standard DB-25-pin connector.

Table J. Lower Parallel Port (DB25) Pin Definitions

SIGNAL	PIN NUMBER
Strobe	1
Data Bit 0	2
Data Bit 1	3
Data Bit 2	4
Data Bit 3	5
Data Bit 4	6
Data Bit 5	7
Data Bit 6	8
Data Bit 7	9
Acknowledge	10
Busy	11
P. End (out of paper)	12
Select	13
AutoFeed	14
Error	15
Initialize Printer	16
Select Input	17
Ground	18-25

2.1.3.3 The serial port is located on the top of the serial/parallel card's external breakout box. The port is a 25-pin RS-232 serial connector that is the software controller for a variety of communication applications. Serial pin definitions are define in the following table.

SIGNAL	PIN NUMBER
Not used	19
Not used	20
Transmit	21
Receive Data	22
Request to Send	23
Clear to Send	24
Data Set Ready	25
Not Used	26
Request to Send B	27
Clear to Send B	28
Select/Clear to Send C	29
Data Carrier Detect	30
Transmit Clock	31
Receive Clock	32
Data Terminal Ready	33
Ring Detect	34
Not Used	35

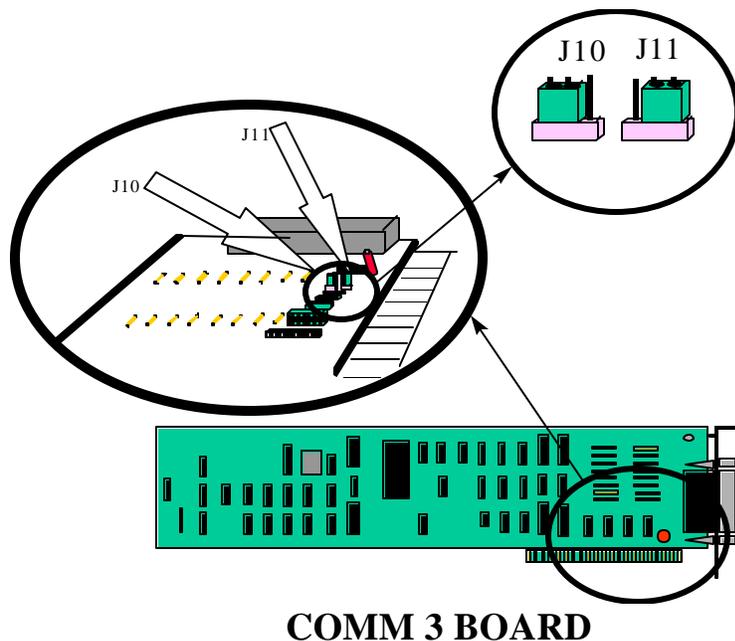
Not Used	36
Not Used	37

---

*The Serial/Parallel Card includes one serial and one parallel port for your computer system. This communications card also allows software emulation of the following terminals: IBM 3278, DEC VT-100, Honeywell VIP770SW, and Sperry UTS-40.*

2.1.3.4 Power should be removed from the machine to be modified.

1. Identify the COMM 3 (serial/parallel) board in accordance to section 1.6.6 above (“How to Remove or Install Any Card.”)
2. Locate J10 and J11 with jumpers in place.
3. Insure the jumpers are configured for FDS II operations as indicated in figure 1.



NOTE: The removal of the COMM 3 (serial/parallel) board from the mother board may expedite this operation.

---

## 2.1.4 Setting Up the Input/Output Card

2.1.4.1 The Input/Output Card contains the system control processor (Intel 8042), keyboard interface, speaker interface, parallel port, serial port, DMA controller, interval timer, interrupt controller, address decoding and generation of control signals for the expansion bus, and six LED indicators for diagnostic purposes.

2.1.4.2 The tone generator provides signals from 37 to 32,000 Hz for a speaker that is mounted on the card guide.

2.1.4.3 The parallel output port provides support for peripherals (usually printers) that require parallel signals.

2.1.4.4 The serial input/output port is RS-232 compatible and can be used with a number of different serial input/output devices. You could connect a serial printer, plotter, modem for asynchronous communications, or graphics tablet to this port. The following are also supported by the I/O Card:

#### Keyboard

2.1.4.5 The keyboard connector is located on the backplane board and extends through the back of the computer.

#### Speaker

2.1.4.6 Your computer has a 2-inch speaker. GW-BASIC supports various tones and durations that enable your computer to play a full range of music. Consult the GW-BASIC manual for specific programming information.

#### Parallel Printer Output Port

2.1.4.7 This parallel printer port is located on the I/O card. Its DB-25 connector is accessible through the rear panel of the computer.

2.1.4.8 The printer port is used to drive Centronics-type print devices (printers or plotters). This standard has been adopted by a large number of manufacturers.

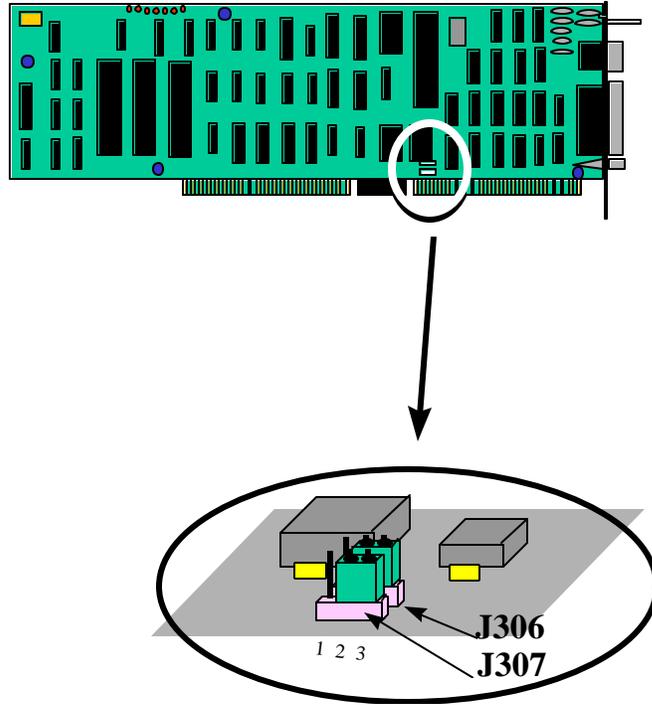
2.1.4.9 Note that the port is brought out of the machine to a DB-25 connector rather than an edge connector. You must have the proper cable to use the DB-25 connector.

2.1.4.10 The operating system, MS-DOS version 3, is configured to use this port as a standard printer port as it is supplied by Zenith Data Systems. The table below defines the connections for the parallel printer.

2.1.4.11 Removal of the I/O Board from the chassis of the Z-248 (in accordance with section 1.6.6 above, "How to Remove or Install Any Card."), will cause system configuration data to be lost. This will necessitate the reconfiguring of the computer system prior to running the software.

2.1.4.12 However, the following installation steps may be completed before returning power to the Z-248 and initializing the system. The information needed to reconfigure the Z-248 maybe obtained by depressing the "CTRL", "ALT", and "INS" keys concurrently and entering "SETUP" when the system prompt is displayed. This information should be hand copied (or print screened) and saved. Once installation is completed and power returned to the computer, redisplay the "SETUP" menu and reenter the retained information.

1. Identify the I/O board (see Figure below).
2. Locate J306 & J307 with jumper in place.
3. The jumpers may be removed by gently pulling the jumpers outwardly from the board.
4. The jumpers now should be secured for future use. This maybe accomplished by attaching the jumpers to the outer pin of each set of 3 pins insuring that the jumpers only touch the outer pin.

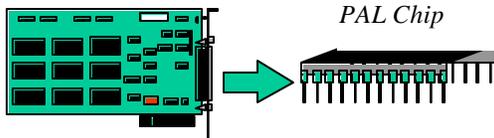


**2.1.5 Setting Up the PAL chip on the Star Gate Card**

2.1.5.1 The PAL (Program Array Logic) chip is placed on the Star Gate card's U24 slot. The input/output (I/O) addresses of the adapter board are determined by this chip and an associated dip switch. The following are the Star Gate card, PAL Chip, and I/O addresses for the Plus-8 board:

*The External Panel  
(or the 'adapter board')*

*Star Gate Card  
(or PLUS 8)*



I/O Addresses for the Plus-8 board	
Port A1	280H
Port A2	288H
Port A3	290H
Port A4	298H
Port A5	2A0H
Port A6	2A8H
Port A7	2B8H
Port A8	2B8H

**2.1.6 Setting Up the Star Gate Card**

2.1.6.1 General Description -- The Star Gate Technologies PLUS 8™ is another term for Star Gate card. An older version of this board is called the OC-8000 (this is no longer being manufactured). The Star Gate card is a multiport communications expansion board. It permits up to eight serial devices to be interfaced with an ISA (Industry Standard Architecture) or EISA (Extended Industry Standard Architecture) bus

personal computer. An additional eight serial devices can be accommodated by adding a second PLUS 8 board to the system unit. An OC-8000 board is an older version that is no longer in production.

2.1.6.2 The PLUS 8 board provides full modem flow control communications for each serial device. This feature is beneficial when used in conjunction with multi-user operating systems and transmission rates exceeding 2400 baud. In this environment the system normally cannot keep pace with incoming data from eight separate sources. Using flow control, the system will receive data as it can be handled, thus insuring that characters are not lost and that files are not corrupted.

2.1.6.3 Communications and flow control are performed with an on-board microprocessor and a separate Universal Asynchronous Receiver/Transmitter (UART) for each device port. Address map selection and interrupt selection are configurable for maximum application flexibility. In addition, the mode select feature permits the modem flow control logic to be disabled for all ports except the first. Serial devices are interfaced to the PLUS 8 board via an External Panel. This eliminates crosstalk between communication channels and alleviates cable congestion behind the system unit. The External Panel has eight, 25 position D connectors for serial devices and is connected to the PLUS 8 board with a fully shielded, 25-conductor cable.

2.1.6.4 Physical Description-- The PLUS 8 board is available in several different version depending upon the number of UARTs on-board and the version of PLD (Programmable Logic Device) and PROM installed. Specifications which apply to all versions are listed in Table 1. The PLUS 8 board requires one full-length expansion slot in the system unit.

2.1.6.5 System Requirements -- In order to achieve proper operation of the PLUS 8 board, the following minimum system requirements must be observed:

1. the host system unit must be an ISA or EISA bus personal computer.
2. One full-length expansion slot must be available for each PLUS 8 board that will be used.
3. When the operating system is either PC-DOS or MS-DOS, the version must 3.0 or higher.
4. At least one IRQ line per PLUS 8 board must be available if interrupt driven.

2.1.6.6 Tools Required -- The only tools required to install the PLUS 8 board into a PC are ¼-inch and 3/16-inch nut drivers.

2.1.6.7 Handling Precautions -- The Plus 8 board contains several components that may be permanently damaged if the board is handled improperly. To avoid accidental damage, follow these recommendations.

1. Before handling the board, touch a grounded object to discharge any static electricity that has accumulated on your body.
2. Never insert or remove the board while power is applied to the system unit. Once the system unit power switch is shut off, wait at least ten seconds for the power supply to discharge before inserting or removing the board.
3. Never connect or disconnect the External Panel interconnect cable while power is applied to the system unit and the peripheral devices.

2.1.6.8 Once the PLUS 8 board is properly configured (see sections 2.5.2 and 2.5.3 below), it may be installed in the system unit. This is done in the following manner:

1. Place the system unit, monitor, and all peripheral device POWER switches in the Off position.
2. Remove the system unit, monitor, and all peripheral device line cords from the service outlets.
3. Remove the system cover carefully.

4. The PLUS 8 board can be installed in any full-length expansion slot. Once a slot is chosen, use the 3/16-inch nutdriver to remove the expansion slot cover plate from the rear panel. Put away the cover plate and retain the mounting screw.
5. Replace PAL on the PLUS 8 board. The PAL is labeled U24 on the board. Below is how you should position chip's 'leads' prior to installing it:

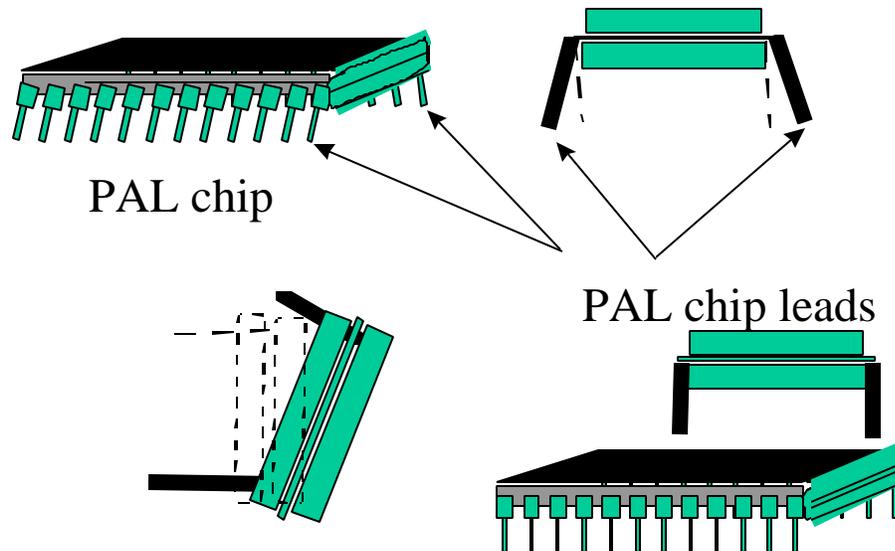


FIGURE K. PAL Chip

6. Press the card guide into the corresponding holes in the front panel of the system unit. The orientation should match that of other guides already installed.
7. Hold the PLUS 8 board by the top, align the card edge connector with the expansion slot connector, and firmly press the board straight down into the expansion slot connector. Make sure that the board is completely seated.
8. Align the slotted hole in the PLUS 8 mounting bracket with the threaded hole in the rear panel of the system unit; then, insert the retaining screw and tighten with the 3/16-inch nutdriver.
9. Replace the system unit cover by carefully sliding it toward the rear. Insert the five retaining screws and tighten using the 1/4-inch nutdriver.
10. Do not reconnect the line cords until the External Panel has been connected.

**2.1.6.9 Hardware Configuration** – Prior to installing the PLUS 8 board into the system unit, it is necessary to verify that the hardware is configured properly for use with the system unit and the application program. The hardware configuration is determined by an 8-position DIP switch and one programmable jumper. These topics are discussed in the following paragraphs.

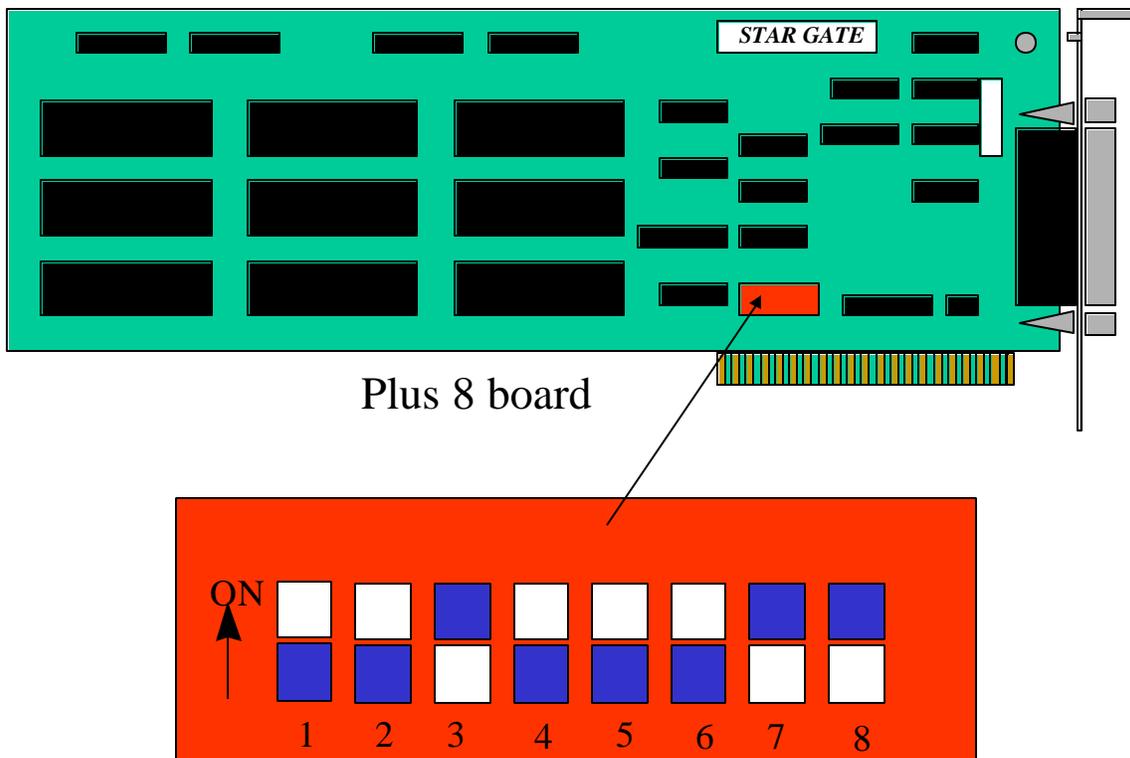


FIGURE J. Plus 8 Board

**2.1.6.10 Multifunction Switch** -- The 8-position DIP switch is labeled SW1. The switches in this bank are used to select interrupt operation and the I/O channel address map. Switches 1 through 6 are used to enable or disable the interrupt levels on an individual basis. Interrupt level 2 has the highest priority and interrupt level 7 has the lowest.

---

## 2.1.7 Setting Up the External Panel

2.1.7.1 The External Panel is a device containing 9 ports: 8 for peripherals and 1 for connection to the Star Gate Card using a fully shielded cable. This cable has a one-to-one pin correspondence, i.e., pin1 at one end is connected to pin 1 at the other end. The Star Gate card and the external panel, together, provide the RS-422 serial interface between the Z-248 and the FDIO peripheral equipment, (RANK, RFSP, CRT).

**CAUTION:** Never connect or disconnect either end of this cable while power is applied to the system unit or to the peripheral devices connected to the External Panel. Otherwise, the PLUS 8 board and/or the External Panel may be damaged.

2.1.7.2 **ALSO, never** mix Star Gate OC8000 components with Star Gate PLUS 8 components, whether they be cable, external panel, and/or the board(s) themselves. By mixing, you WILL 'fry' the boards!

2.1.7.3 Verify that all POWER switches are Off, and the line cords are removed from the service outlets. Install the interconnect cable between the J1 on the External Panel and the 25-position plug on the PLUS 8 board. After the interface cable is terminated at both the External Panel and the PLUS 8 board, reconnect all the line cords to the system unit, monitor, peripheral devices, and service outlets.

2.1.7.4 Universal Asynchronous Receiver Transmitter (UART) – Communication between the PLUS 8 and each of the peripheral devices is accomplished with *universal asynchronous receiver transmitter* (UART) devices. Each UART provides an independent, full duplex, serial communication channel. Operating mode, data format, transmission rate, and protocol for each channel are determined completely under program control.

2.1.7.5 Microprocessor -- There are two microprocessors, one on the PLUS 8 board and another on the External Panel. Each microprocessor is an 8051 single-component microcomputer having a mask-programmed read only memory (ROM). The microprocessor residing on the PLUS 8 board provides the interfaces between the host system and the UARTs while the microprocessor in the External Panel controls and monitors the physical EIA-232 interface. Both microprocessors are synchronized in a master/slave relationship.

2.1.7.6 Protocol signals are passed between the microprocessors via a high speed differential communications link. The latency imposed by this technique is approximately 450 microseconds, which is less than half the time required to receive a character transmitted at 19.2KB. Should one of the flow control lines change state, the change will be reported within a time frame which allows reception from the peripheral device to be temporarily suspended. Conversely, transmission to a peripheral device will be temporarily suspended if the peripheral device, by means of flow control signals, indicates that it cannot maintain the bandwidth requirement. In either case, characters will NOT be lost.

2.1.7.7 The following are the pinouts:

Pin	Function
1	Ground
2	Channel 1 Transmit Data
3	Channel 1 Receive Data
4	+5 Volts DC
5	Transmit Data (+)
6	+12 Volts DC
7	Receive Data (+)
8	-12 Volts DC
9	Channel 2 Receive Data
10	Channel 2 Transmit Data
11	Channel 3 Receive Data
12	Channel 3 Receive Data
13	Channel 4 Receive Data
14	Channel 4 Transmit Data
15	Channel 5 Receive Data
16	Channel 5 Transmit Data
17	Channel 6 Receive Data
18	Transmit Data (-)
19	Channel 6 Transmit Data
20	Receive Data (-)
21	Channel 7 Receive Data
22	Channel 7 Transmit Data
23	Channel 8 Receive Data
24	Channel 8 Transmit Data
25	Ground

**CAUTION:** Never connect or disconnect either end of this cable while power is applied to the system unit or to the peripheral devices connected to the External Panel. Otherwise, the PLUS 8 Board and/or the External Panel may be damaged.

2.1.7.8 Verify that all the POWER switches are OFF, and the line cords are removed from the service outlets.

2.1.7.9 Install the interconnect cable between J1 on the External Panel and the 25-position plug on the PLUS 8 board.

2.1.7.11 After the interface cable is terminated at both the External Panel and the PLUS 8 board, reconnect all line cords to the system unit, monitor, peripheral devices, and service outlets.

## 2.2 Connecting Your Peripherals to the External Panel

*From one to eight peripheral devices may be connected to the External Panel. Each device is connected to a 25-position female receptacle wired for compliance with Electronic Industry Association (EIA) standard EIA-232 for Data Terminal Equipment (DTE).*

*Star Gate Technologies, Inc. recommends that the interface cable used for each peripheral device have shielded cable and metalized RFI/EMI connector hoods. Noncompliance with these recommendations may result in increased RFI/EMI emissions.*

*The table below identifies the pin assignments for EIA-232 compliance. If a particular peripheral device does not require the modem handshake signals, only pins 2, 3, and 7 need to be used.*

*Place the peripheral device POWER switch in the Off position.*

*Connect the peripheral device to any one of the ports available on the External Panel.*

Pin	Signal	Description
1	Shield	Protected Ground
2	TXD	Transmitted Data
3	RXD	Received Data (input)
4	RTS	Request To Send (output)
5	CTS	Clear to Send (input)
6	DSR	DCE Ready (input)
7	GND	Signal Ground
8	DCD	Received Line Signal Ground
20	DTR	DTE Ready (output)
22	RI	Ring Indicator (input)

## The Peripherals

*Peripherals are the CRT, RANK, and RFSP. These are logically connected to the FDS II system via ports on the OC-8000 circuit board. The port assignment selection allows for proper hardware configuration during initial installation or for changes that may become necessary in the event of hardware port failure or desired system configuration changes. Port assignment should not normally be changed except by maintenance personnel.*

## What Are Flight Strips?

*Flight strips are output from the ARTCC to specific FDS II CRT's and RFSP's based on prescribed site adaptation parameters. Site adaptation requirements for each FDS II user facility are determined by the ARTCC and are set into the ARTCC computer program. This information allows the NAS computer to selectively communicate with FDS II devices. This insures that arrival flight strips, for example, are properly routed from the ARTCC to the FDS II arrival RFSP and not to departure. The site adaptations also specify time parameters. These parameters may be set from 5 to 30 minutes and determine at what time the ARTCC computer will transmit flight plan data to FDS II. For arrivals and overflights, this information represents the number of minutes prior to the estimated time the aircraft would be over the coordination fix. For departures, a strip would be generated at the prescribed time parameter prior to the proposed departure time. Site adaptation changes must be coordinated with ARTCC data systems personnel.*

## What is RANK pairing?

*RANK pairing permits the user to assign a specific replacement flight strip printer (RFSP) or cathode ray tube (CRT) as the output device for a specific RANK, and to specify which RFSP will be the alternate output device (pair alternate) for the pair. The alternate output device for a RANK paired with a CRT is always an RFSP. From the Main Menu press the function key <F2> for the Reconfiguration Menu, then the <F3> key to arrive at the RANK Pairing Menu. From the RANK Pairing Menu select the device number of the RANK you want to pair up, and input the device number of the RFSP or CRT you want to pair it with.*

*Also, RFSP pairing is to provide a link between a RFSP and a CRT. To get to the RFSP Pairing Menu, depress the <F7> key while in the Reconfiguration Menu. When the RFSP Pairing Menu appears on the system console, select the desired RFSP and the CRT it is to be paired with.*

---

### 2.2.1 Connecting Your Printer (RFSP)

The printer must be connected (interfaced) to the host device by an RS-422 cable. The interface cable is not supplied with the printer, but you can make your own cable based on the following pin out information:

RS-422 Serial Interface Cable Pinouts ES100

<u>Pin</u>	<u>Signal</u>	<u>Signal Source</u>
1	Frame Ground	--
7	Signal Ground	--
15	Received Data (+)	Host
16	Received Data (-)	Host
19	Transmitted (+)	Printer
25	Transmitted (-)	Printer

Once you have the correct shielded interface cable and DB25 connector, connect it .

1. Locate the serial interface cable jack on the back of the printer.
2. Carefully plug the cable connector into the serial interface jack until it is firmly seated.
3. Fasten the cable connector to the jack with two captive screws. This prevents the cable from working loose.
4. Connect the other end of the interface cable to your host system .
5. Press the O (off) arm of the red power switch on the side of the printer.
6. Turn the printer for access to the back. Firmly plug the AC line power cord into the AC jack. Turn the printer back around.
7. Plug the other end of the AC line power cord into a 3-wire, grounded AC power receptacle. Do not remove the ground prong from the AC line power cord plug.
8. Press the 1 (on) arm of the red power switch. The green POWER indicator will come on, indicating that power is available.

If this is the first time that the printer has been turned on and paper is not loaded, the printer will beep three times and the red FAULT indicator will come on steady. Once paper is loaded, the indicator will go out. Paper loading is discussed in Section 3.

During printer operations you may encounter a flashing red FAULT light. This means that the printer has encountered a fault. The flashing light is accompanied by an audible alarm to alert you to the fault condition.

## **2.2.2 Connecting your CRT**

2.2.2.1 The CRT provides the user with a temporary display of data messages exchanged with the ARTCC host NAS computer. Under normal conditions, the CRT is fully independent and does not require controller operation. The CRT is paired to a RANK and is used as a backup to display flight strips. The screen will be divided into two horizontal display areas by a series of 80 equal signs ("="). The areas are:

- a. Flight Strips - incoming flight data and general information messages from the ARTCC host NAS computer.
- b. Composition Area - for visual display of messages composed on the paired RANK.

2.2.2.2 A power switch is located on the lower left front of the unit. When powered on, the display will perform an internal self test and initialize itself for proper operation. Power should remain applied to the CRT except for unusual circumstances.

2.2.2.3 After initial power on, the CRT should display a "blinking" cursor in the lower part of the display area. A series of equal signs ("=") is used to divide the screen into the message composition area and the message display area

## **2.2.3 Connecting Keyboard (RANK)**

2.2.3.1 The RANK is the primary device for user inputs into the FDS II system. Used for composing and editing messages, the RANK is similar in design and operation to most computer keyboards.

2.2.3.2 A power switch is located on the left rear corner of the RANK. When power is applied, the RANK is illuminated and ready for use. Power should remain applied to the RANK except for unusual circumstances.

2.2.3.3 A control knob is located on the top panel (upper right) to adjust the brightness of the keyboard illumination. Turn the knob counter-clockwise to decrease the brightness.

2.2.3.4 The alphanumeric keys on the RANK function like the keys of a standard typewriter. In addition, 17 editing keys are provided to aid in message construction.

2.10.7.5 The RANK keys are divided into two basic sections, each identified by a separate color. The white keys are used for message composition while the blue keys are used for editing. The green enter key serves to terminate a message, if one is being composed, and starts the message transmission sequence. If there is no message in the composition area, the last message accepted by FDS II for transmission to NAS from that RANK is recalled for editing and re-transmission.

2.10.7.6 The yellow message waiting light (MWL) is not used in FDS II operation.

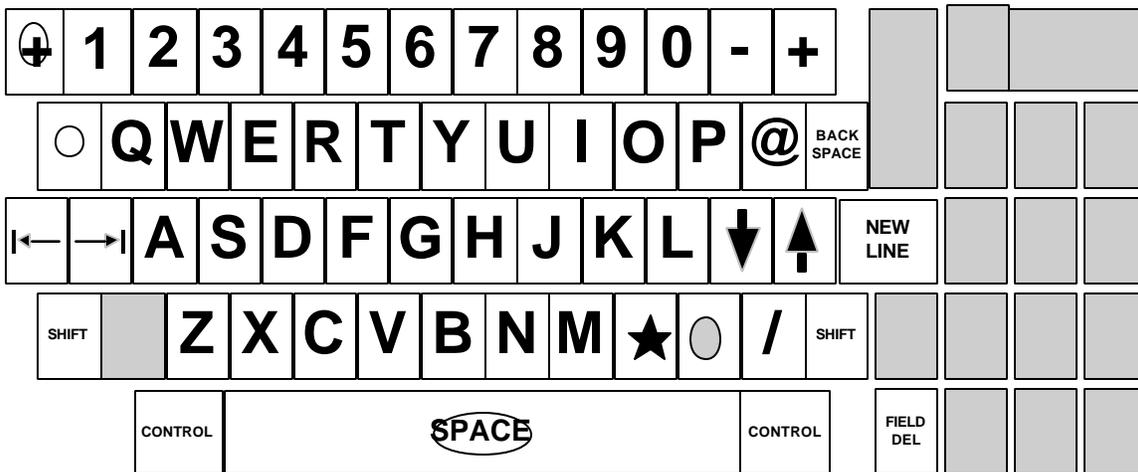
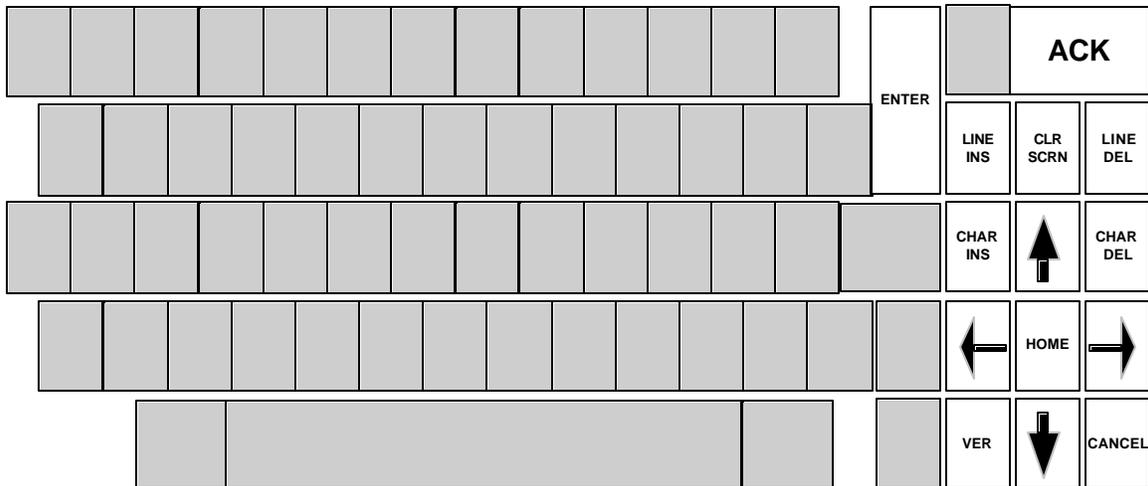


Fig. 2-1: RANK WHITE KEYS



## 2.3 Connecting the Modem To Your Computer (Paradyne)

2.3.1 There are two types of modems: acoustic-coupled and direct-connect. Both are attached to your computer the same way. However, the direct-connect also must be directly attached to your telephone line.

2.3.2 To attach your modem to your computer, plug one end of your modem cable into the serial connector on the back of your computer. Secure the other end to your modem.

### Modem Connection

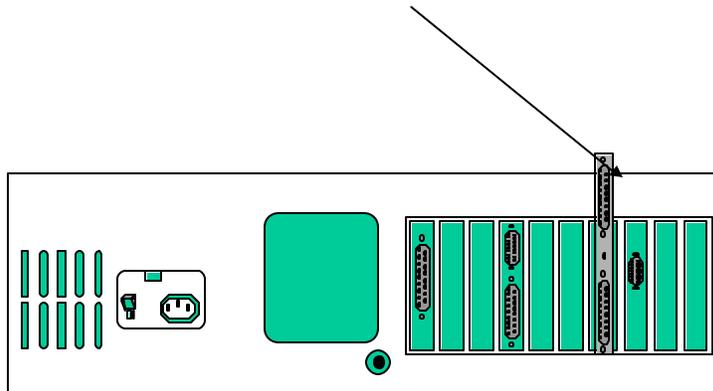


Figure 12. Modem Connection

2.10.6.1 The modem provides the communication interface between any specific airbase and its supporting ARTCC. The modem originally authorized for FDS was developed by Paradyne Corp. This type of modem is capable of transferring 2.4KB, 4.8KB, or 14.4KB of data. Usually one or more Paradyne modems are needed to support the long lines communications between the airbase and the servicing ARTCC and any airbases connected as tail circuits.

#### 2.10.6.2 PARADYNE MPX 2400, 4800, and 9600 MODEMS

Three basic models make up the Paradyne series (which most sites have today) or the MPX Modem Series: MPX 2400, MPX 4800, MPX 9600. These modems are available with the following optional features:

- Diagnostics Microcomputer (DMC)
- 4-Port Multiplexer (MUX) (not available on MPX 2400)
- Eye Pattern Generator (EPG)
- Asynchronous-to-Synchronous Converter (ASC)
- Digital Data Network (DDN) Interface
- Dual-Call Auto-Answer (DCAA)
- DMC Memory Expansion

2.10.6.2 If you are installing a 2400, 4800, or a 9600 modem, first refer to the installation planning instructions for an overview of the installation requirements. Once the modem is in place and attached to the phone lines and terminal equipment, strap the modem for FDS.

2.10.6.3 A complete checkout of the modem and data system is required after installation. This testing is accomplished through the use of the front panel controls and indicators. These tests and related indications are also used for fault identification and isolation. Detailed information for testing the modem, and the interpretation of the test results will not be covered in this manual. However, you may refer to your Paradyne manual for that.

2.10.6.4 Operation of the modem is automatic after installation and checkout. Simple preventive maintenance procedures are required on a quarterly basis and are described in detail in your Paradyne manual.

## Overview

2.10.6.5 The MPX 2400, 4800, and 9600 Modems are high-speed synchronous modems for use in point-to-point or multipoint applications on 4-wire leased lines. These modems are also compatible with earlier counterpart MP and LSI modems when operating in non-diagnostic environments. However, when operating in an ANALYSIS diagnostic environment, all modems are compatible except for the MPX 9600.

2.10.6.6 The MPX Modem is compact and versatile and provides built-in strapping options that allow you to tailor the modem functions to your individual telecommunications requirements. Most software option strapping can be performed using the front panel controls and indicators.

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## 1.6.7 Powering Up the Modem (Paradyne)

1.6.7.1 Before operating the modem, all control and indicator functions should be thoroughly understood.

### Operating Your Modem

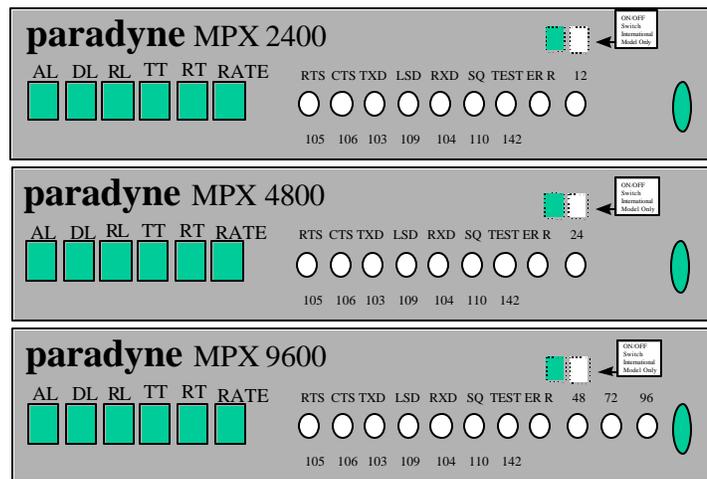
1. Perform the power-on procedures for the local DTE.
2. Check that operation is normal.
3. Coordinate remote site power-on and check that operation is normal.
4. Ensure that all switches are in the normal data position.
5. Perform system checkout and test procedures.

The system will now operate in both directions. If it does not, call for service.

## Controls and Indicators

1.6.7.2 Controls and indicators necessary to operate the modem are located on the front of each card. The basic modem controls and indicators are described in this chapter, and the optional features are described later in this manual.

1.6.7.3 Five pushbutton switches that control various modem test functions, a rate switch, nine indicators (eleven for the MPX 9600), and a recessed toggle switch are located on the front panel. The secondary strap loading function (SLF), six pushbutton controls, and six of the indicators, are enabled when you place the unmarked toggle switch in the on (up) position.



**Front Panel Controls and Indicators**

### 1.6.7.4 Turning On and Operating Your Modem

- Ensure that the AC power available is the proper voltage and wattage.
- The circuit breaker controlling AC power to the AC power outlet should be tagged for identification and must be turned on to apply power.
- Ensure that the phone lines are connected and the strap options are configured according to your requirements. Ensure that DTE connections are configured.

1.6.7.5 Perform the following turn-on procedures:

1. Coordinate turn-on with other modem locations.
2. Plug the power cord into the AC power outlet. The fan should turn on, and several front panel indicators may light depending on modem status. (International modem requires turning on the front panel power switch.)
3. If no indicator turns on, press the AL front panel pushbutton. The TST indicator should light. If not, check the power cord, AC power source, and primary AC power fuse.

System initialization is accomplished automatically by the modem.

## Normal Operation Indications

1.6.7.6 Normal operation usually can be determined by monitoring the front panel controls and indicators.

- All six pushbutton controls are in the released position.
- The strap load switch is off (down)
- When the modem is transmitting and receiving data at the primary bit rate, the RTS, CTS, LSD, and 96 (MPX 9600) indicators are lit.
- The TXD and RXD indicators flicker.
- The TST, ERR, 12,24,48, and 72 indicators are out.

## Turn-Off Instructions

1.6.7.7 To turn off the domestic modem, unplug the power cord from the wall receptacle.

1.6.7.8 To turn off the international modem, place the front panel ON/OFF switch to the OFF position. All modem indicators will go out.

## Error Recovery Instructions

1.6.7.9 There are no special error recovery instructions for the modem; however, be sure to coordinate any turn-off and turn-on procedures with the other stations in the communications network.

## System Checkout / Test Mode Procedures

1.6.7.9 System checkout procedures test each phase of system operation and test both ends of the communications link. If these procedures indicate a system failure or system degradation, call for service.

1.6.7.10 The following checkout procedures require no external test equipment. An internal test is generated to test modem performance. As the modem produces the expected indications, continue the checkout until proper operation is assured. To bench-test two modems, strap modem transmitter power output levels for the lowest possible level (-15 dBm) to approximate phone line conditions.

## Initial Conditions

1.6.7.11 Initial Conditions

- Perform the power-on procedure for the local DTE and check that operation is normal.
- Coordinate remote site power-on and check that operation is normal; if the modem is strapped for remote loopbacks, further remote-site operator intervention is not necessary.
- Perform the power-on procedure for the modem and place all switches in the normal data position.

1.6.7.12 If the modems are connected via a phone link or are connected to the DTE, several indicators may be lit.

- LSD lights in the full-duplex mode.
- RTS and CTS light when RTS is provided by the DTE.

## Physical Description

2.10.6.7 The modem chassis assembly consists of rigid molded plastic top and bottom half-shell covers with front and rear bezels. The chassis accommodates up to three 8-inch by 17-inch circuit card assemblies fitted with front and rear panels. These cards contain all necessary controls, indicators, and connectors; there is no motherboard or backplane. The basic modem card is located on the bottom of the case, the optional DMC card in the middle, and optional MUX card on top. If only one of the two optional cards is installed, it occupies the center position. The basic modem card is placed into a groove in the bottom half-shell cover and the option cards stack in an interlocking manner on top of the modem card. If the option cards are not used, blank panels are provided in the bezels to take up the extra space. Once the card(s) are in place, the top half-shell cover interlocks with the bottom half-shell cover and is guided to rest against the modem card. A special clip bracket provides additional support for the optional cards and maintains their spacing. The front and rear bezels slide onto the completed assembly and are secured in place by two twist locks.

2.10.6.8 All components for the modem, including the power supply, mount on the basic modem circuit card assembly. Interconnection to the optional circuit boards is accomplished through two 60-pin connectors mounted on the edge of the modem card. Flat, flexible cables connect the optional cards to the modem connectors. The modem is forced-air cooled by a fan mounted in the left side of the lower half-shell cover.

2.10.6.9 The modem is essentially the same for domestic or international use. The only differences are the inclusion of a required ON/OFF power switch on the international modem front panel, and the method of telephone line (VF) on the rear panel. The domestic VF connector is a modular phone jack; whereas, the international modem has a 4-terminal strip that connects to special VF components for high voltage isolation requirements (PTT circuitry).

## MODELS

### MPX 2400

2.10.6.10 The modem provides data communications at 2400 bps across 4-wire leased telephone lines, with a fallback rate of 1200 bps. This modem complies with CCITT V.26 and Bell 201C (4-wire leased lines) specifications.

### MPX 4800

2.10.6.11 This modem provides data communications at 4800 bps across 4-wire leased telephone lines with a fallback rate of 2400 bps. The MPX 4800 accepts an optional 4-port multiplexer (MUX) channels on one VF telephone circuit. This modem complies with CCITT V.27 specifications and also provides 25 ms training mode for multidrop application.

### MPX 9600

2.10.6.12 This modem provides data communications at 9600 bps across 4-wire leased telephone lines with fallback rates of 7200 and 4800 bps. The MPX 9600 accepts an optional 4-port MUX capable of combining up to four 2400-bps data channels on one VF telephone circuit. This modem complies with CCITT V.29 specifications.

## Rapid POLL Mode

2.10.6.13 The MPX 9600 modem is also used as a multidrop modem in the Rapid Poll mode. This mode requires an initial training sequence of 726 ms between the master and each remote modem. Once this initialization has been accomplished, the master modem requires only a 20-ms short training sequence to lock to a remote modem transmission.

2.10.6.14 The master modem operates in the constant carrier mode; its transmitter is always on and its receiver is normally off. The remote modem are strapped for controlled carrier. Their transmitters are normally off and their receivers are normally on, so the remotes constantly maintain line signal detect (LSD) to the remote data terminal equipment (DTE).

2.10.6.15 When polling the remote DTE, the DTE controller sends request to send (RTS) to the master modem and immediately obtains a clear to send (CTS) because the transmitter is on. Since communications from the master modem to the DTE are constantly open, the controller free to poll the remote DTE.

2.10.6.16 When a remote DTE recognizes its poll address, it raises RTS which turns on the remote modem transmitter. The remote modem training sequence that turns on the master modem's receiver. This sequence allows the master modem to train and send LSD to the DTE controller rapidly. At the same (at the end of the training sequence transmission), CTS is sent from the remote DTE. To stop the data flow, the remote DTE must drop RTS.

## Optional Features

### Diagnostic Microcomputer (DMC)

2.10.6.17 This feature allows the modem to connect to the ANALYSIS Automatic Network Management System via an independent secondary asynchronous frequency shift keying (FSK) channel. The DMC Feature provides the network manager with configuration data and ongoing communications of high quality; the data includes diagnostic and restoral capabilities. This feature is available with RD support for compatibility with the previous Paradyne ANALYSIS Remote Diagnostic (RD) 4400 Series system.

### 4-Port Multiplexer (MUX)

2.10.6.18 The MUX Feature permits up to four independent data channels to communicate simultaneously through the same MPX 4800 or 9600 modem.

### Eye Pattern Generator (EPG)

2.10.6.19 This feature indicates specific transmission line problems. Line interference problems, such as phase jitter, amplitude hits, impulse noise, or amplitude distortion produces a specific deviation in the ideal eye pattern as seen on an oscilloscope.

### Asynchronous-to-Synchronous Converter (ASC)

2.10.6.20 The ASC Feature (Port A) converts incoming asynchronous data from the EIA interface into synchronous data for the modem channel. This feature can operate at data rates of 9600, 7200, 4800, 2400, or 1200 bps. However, the modem and DTE must operate at the same data rate.

2.10.6.21 ASC (MUX) – This feature is used with the 96/48 MUX and is capable of simultaneously converting three channels of asynchronous data for MUX ports B, C, and / or D. (Port A requires the async option above.)

## Digital Data Network (DDN) Interface

2.10.6.22 This feature optimizes the interface between a pair of modems and the telephone digital data network, allowing the modems to be used as analog extension units to provide data transmission to areas not covered by the digital network.

## Dual-Call Auto-Answer (DCAA)

2.10.6.23 The DCAA Feature is available with the MPX Modems equipped with DMC. The DCAA is a VF-dial backup for dedicated 4-wire leased telephone circuit. This feature automatically answers two calls at the same location, one for one modem transmit VF connection, and the other for the receive VF connection. When both calls are completed, the modem is transferred from leased to dial telephone lines and full-or half-duplex operation can resume.

## Customer-Supplied Equipment

2.10.6.24 You must supply the following equipment:

- Standard input/output cables (RS-232-C) from your DTE to the standard EIA 25-pin female connectors on the modem back panel.
- DCAA feature, two 4-conductor VF cables with 6-pin modular connectors on each end to connect the DCAA to the telephone lines terminated for permissive mode.
- DCAA feature, two telephone instruments to provide manual capability.

2.10.6.25 Installation Your Modem

- Prepare the installation site.
- Select the correct option straps for your configuration.
- Ensure that connecting cables between the modem and DTE will not exceed 50 feet and that the physical location of the modem permits cable connection.
- Mount the modem in a rack or on a table.
- Connect the modem to the DTE and transmission lines.
- Ensure that the proper ac power is available.
- Connect the modem to the ac power.

2.10.6.26 Site Considerations

Ensure that the site is clean, well lighted and free from environmental extremes.

Ensure that the modem will be mounted in a well-ventilated area. One EIA standard 19-inch wide rack shelf with 5 ¼ inch vertical clearance may accommodate two modems; however, you must remove the modems from the shelf to access the circuit card (Figure 2-1).

Ensure that the modem will be installed within 8 feet of a grounded ac power outlet capable of furnishing the required power.

## Optional Features Installations

2.10.6.27 Field installation of the DMC and MUX optional features requires either the 2-card or the 3-card installation kit.

#### 2.10.6.28 Installing MPX Features

1. Unplug the modem ac power cord.
2. Release the latch screws on the front and rear bezels of the modem.
3. Remove the front and rear bezels, and lift off the top cover.

**NOTE:** When assembling and disassembling the modem, ensure that insulating material is intact.

**NOTE:** When installing the MUX Feature with the DMC Feature, the MUX card mounts on top of the DMC card instead of the modem card.

4. Disconnect the fan cable from the power supply on the center right side of the modem. Remove the modem card from the bottom of the case and set it on a flat surface.
5. Install two double female aluminum standoffs.
6. Plug in the two bottom connectors of the wiring harness at P1 and P2 on the left edge of the modem card.
7. Place the feature card above the modem card at an angle sufficient to slip the L-shaped foot on the bottom left side of the feature card and rear panels into the corresponding slots in the top of the modem panels.
8. Lower the feature card until it sits flat on top of the modem card. The straight foot on the bottom right side of the front and rear panels fits into the notches in the top of the modem panels. Secure feature card to standoffs with hardware. Attach ribbon cable connectors P1 and P2 to MPX and/or internal DCAA.
9. Slip the supporting bracket onto the cards. Place the assembled cards into the bottom of the case and connect the fan cable to the power supply.
10. Loosen the hardware on the ac receptacle and DTE connector and install grounding strap on rear panel.
11. Perform any required hardware strapping.
12. Lower the top case cover into the guides in the bottom cover and gently slide the top cover down until the two halves meet.
13. Attach the new front and rear bezels and engage the latch screws.
14. Plug in the modem ac power cord.

## Preinstallation Checks

2.10.6.29 After the hardware wire straps have been selected, use the following checklist before proceeding with the installation:

- Ensure that the ac line fuse is correct for the model:

MPX 2400:

110-120V, 1 ¼" x ¼", Slo Blo, 1.0 amp, 250V. 230V, 5mm x 20mm, Slo Blo, 0,5 amp, 250V.

MPX 4800:

110-120V, 1 ¼" x ¼", Slo Blo, 1.0 amp, 250V. 230V, 5mm x 20mm, Slo Blo, 0,5 amp, 250V.

MPX 9600:

110-120V, 1 ¼" x ¼", Slo Blo, 1.0 amp, 250V. 230V, 5mm x 20mm, Slo Blo, 0,5 amp, 250V.

AC power requirements are specified on the sales order and are established at the factory.

The correct power supply assembly for each installation is shipped with the modem. Power supply voltage and fuse requirements are not selectable in the field.

Fuse replacement in the field is limited to replacement of the exact fuse supplied with the unit, that is, the same size and current rating.

Now you are ready to connect the I/O interface cables and VF telephone cable to the modem.

## System Connections

2.10.6.30 The MPX Modem must be correctly connected before ac power is turned on to prevent damage to the modem and to ensure efficient operation of the system. Connections to the modem rear panel consist of:

- Telephone Interface
- DTE Interface

### Telephone Interface

2.10.6.31 **Domestic Modem**—The cable kit supplied with your modem contains all domestic phone line connectors except for the type 829 channel interface unit. This cable kit includes a 14.5-foot telephone cable with modular phone plugs on each end, and a short (about 6 inches) adapter cable with a modular phone jack on one end and spade lugs on the other.

2.10.6.32 VF Telephone Cable Features 2829-001 through 2829-004, modular phone plug to spade lugs, are available in lengths from 7 to 50 feet. These features also include the 829 adapter.

**NOTE:** Advance coordination with the local phone company may be required to use the type 829 channel interface unit.

2.10.6.33 **International Modem** --- to connect the international modem, the following steps are necessary:

1. Locate the standard phone cable supplied with the modem and bend each of the four wire ends into a hook.
2. Loosen the VF screw terminals and wrap the four wires around the terminals and wrap the four wires around the terminal. The TX pair is red and green, and the RX pair is yellow and black. It does not matter which wire of the phone line pair connects to which screw in a given pair since they are transformer—coupled, balanced, and floating. For proper 4-wire operation, the TX terminals on one modem must be connected to the RX terminals of the other modem via the phone lines.
3. Tighten the screws and connect the wires at the other end of the phone cable to the telephone terminals.

### Data Terminal Equipment Connections

Both domestic and international modems use the standard 25-pin digital interface with data terminal equipment (DTE).

## Strapping

2.10.6.34 Strapping is a procedure that must be performed to tailor the MPX Modem to your network requirements. These straps are selected at the time of installation and remain in place until the system is reconfigured. However, before you strap the modem, check with the network manager for your installation strapping scheme.

Two types of straps are used: Hardware and Software

### Hardware Strapping

2.10.6.35 Hardware straps consist of two or three wires with an insulated shorting bar and miniature dual in-line package (DIP) switches. The hardware wire straps consist of either a pair of or three wire pins protruding from the circuit card.

- A strap is identified by a letter, and the pins are either shorted or left open. To short the pins (Strap IN), an insulated shorting bar is provided. For an open connection, (Strap OUT), the shorting bar is set down on one of the pins for storage.
- Three-wire straps are identified by two letters, one at each outside wire.
- The center pin is shorted to one of the outside pins. Hardware wire strapping is accomplished through the use of pins that protrude from the circuit card and that can be connected by an insulated shorting bar. The arrangements of the wire straps are:

2.10.6.36 The miniature switch occupies a DIP component location on the card. Two types of miniature switches are used: *rocker* and *slide*. The slide switch is more common type, and is marked ON for the on or closed position.

### 2.10.6.37 Gaining Access to Hardware Strap

1. Release the latch screws on the front and rear bezels of the modem with a small screw driver. Remove the front and rear bezels and lift off the top cover.
2. Determine the required setting of Wire Straps A and B/D (MPX 2400, B/C) for external TX clock source and then position the shorting bars accordingly.
3. Replace the top cover and the front and rear bezels.

### Software Strapping

2.10.6.38 Software strapping is the method whereby certain modem functions are selected by altering the contents of specific addresses in memory. This selection is achieved using front panel pushbuttons and LED indicators whose primary modem functions are changed to software strapping function by a recessed toggle switch.

2.10.6.39 The memory addresses and contents required to implement various modem functions are listed in the software strapping tables which follow.

2.10.6.40 Software strapping planning sheets are included in Appendix B to enable you to sequence through the addresses and simply match up lit and unlit LEDs to attain a desired address and load new information without having to convert from hexadecimal notation to binary.

### Software Strap Enabling.

2.10.6.41 An unmarked recessed toggle switch located on the right hand side of the front panel selects the operating mode of the LEDs and pushbuttons. The down position is for normal mode operation and the up position enables software strap loading. The following explanations of the LEDs and push buttons require that the recessed unmarked toggle switch be placed in the up position (and returned to the down position after strapping is complete).

### Strap Loading LED indicators –

2.10.6.42 The six rightmost LEDs on the front panel are used in software strapping. This manual covers MPX 2400, 4800 and 9600, each of which have a slightly different front panel. The same LEDs are used to depict addresses and their contents, however, the labeling of these LEDs will vary.

2.10.6.43 Pushbuttons cause the address or the contents of that address to be displayed. The address is determined by the six rightmost LEDs (DL switch out), while the contents of that address are determined by the four rightmost LEDs (DL switch in).

2.10.6.44 Strapload Pushbutton Functions -- All six self-latching pushbuttons are used in the software strap loading procedure. The first two pushbuttons, AL and DL, are used to reach an address and display its contents.

**AL** The function of AL is contingent upon the position of DL.

- a. With DL down, pressing AL in and out causes storage of the information selected and displayed on the lower four LEDs.
- b. With DL up, pressing AL causes the address to advance when the button is pressed down and advance again when the button is pressed and returns to the out position. Thus, it is possible to advance through to the desired address twice as quickly as by just using DL alone.

**DL** Controls the function of AL.

- a. When DL is up, the current address is displayed on the six rightmost LEDs.
- b. When DL is pressed down, the binary contents of the address just displayed (when DL was up) are shown on the four rightmost LEDs.
- c. When DL is pressed again and returned to the out position, the address advances.

2.10.6.45 The four rightmost switches are used in conjunction with AL to change the contents of address. The change is set up by placing the four rightmost switches either in (which will cause the corresponding LED to light) or out (which will cause the corresponding LED to go off). To make the change and load new information into memory, AL is then pressed in and out.

### Software Strapping Table References



- 4 The fourth LED from the right is controlled
- 3 The third LED from the right is controlled
- 2 The second LED from the right is controlled
- 1 The rightmost LED is controlled

Strapping Plan Worksheet – The relationship between strap addresses and HEX settings is not necessary to strap the modem.

### Strap Loading Functions Summary

2.10.6.46 *To advance the address*, press and release DL. The address advances by one. Press and release AL to advance address two increments (DL must be out).

2.10.6.47 *To go to a lower address*, move the recessed toggle switch to the down position and back up. The strap location address automatically returns to 00 and then can be advanced to the desired address.

2.10.6.48 *To display the current strap selection* (for the address indicated), press DL. The four rightmost indicators light to indicate contents of the address selected.

2.10.6.49 To change the strapping, choose the desired strap selectors from the strapping table, and press IN on pushbuttons RL, TT, RT, or RATE, as appropriate, to turn selector on. Leave the pushbuttons OUT to turn the selector off.

NOTE: Set all option selectors either OFF or ON as required for the function desired within each strap address location(s).

#### 2.10.6.50 Typical Software Strap Loading Operation

1. Fill out the Strapping Plan Worksheet.
2. Power on the modem.
3. Place all pushbutton switches in the OUT position.
4. Place the recessed toggle switch in the UP position. The alarm indicator will light and remain lit, while the six rightmost LED indicators will go off indicating that the starting address of (00) has been selected automatically.
5. Use the pushbutton switches and LED indicators (as described in the preceding sections) to step through to the desired address and load new data into memory.

2.10.6.51 The strap addresses advance according to the same sequence shown in the strapping tables and strapping worksheet. Simply match the ON/OFF condition of the LED's depicted in the tables to those on the modem to reach the desired address (off=Unlit; ON=lit)

- a. Press DL in then out to advance to the next address; or

- b. With DL out, press AL in and out to progress through the addresses twice as fast.
- c. When the desired address is reached, press DL in to examine the contents of memory.
- d. If necessary, change the contents of that address by using the RL, TT, RT, and RATE switches to set up new information. Then load this data by pressing the AL switch in and out.
- e. Repeat steps a. through d. until all software strapping is complete.

**NOTE:** the strap addresses increment in one direction only. To go back to a lower address in the table, move the recessed toggle switch down and then up to restart the sequence at address 00.

6. When the software strapping is complete, return the self-latching pushbuttons to the out position and move the recessed switch down (off).

## Strapping Tables

2.10.6.52 The following tables include both hardware and software strapping. The hardware strapping makes reference to specific wire straps as depicted on the printed circuit card illustrations. The software strapping makes reference to address locations in EEPROM memory and the data which must be stored at those locations to implement modem functions. This nonvolatile type memory will not be lost if power is removed from the modem. Sometimes, one function may involve more than one address; this will be noted in the table.

2.10.6.53 Final strap selection depends upon the features installed and network configuration. However, the tables include arrows which indicate the function most commonly used and are the standard settings that come preset from the factory.

## MPX Optional Features

### Overview

MPX modems may have one more of the following optional features:

- Diagnostic Microcomputer (DMC)
- Dual-Call Auto-Answer (DCAA)
- DMC Memory Expansion
- 4-Port Multiplexer (MUX)
- Eye Pattern Generator (EPG)
- Asynchronous-to-Synchronous Converter (ASC)
- Digital Data Network (DDN) Interface

The basic modem card is located on the bottom of the case, the optional DMC card is in the middle, and the optional MUX card is on top. If only one feature card is installed, it occupies the center position. The basic modem card is placed into a groove in the bottom half-shell cover, and the DMC and MUX cards stack in an interlocking manner on top of the modem card. The EPG, ASC, and DDN are daughterboards that mount on the basic modem card.

### Diagnostic Microcomputer

The Diagnostic Microcomputer (DMC) permits testing and diagnostics of telephone line and modem problems. It monitors and controls certain modem operations as directed from a remote central location by the ANALYSIS Automatic Network Management System. The DMC communicates with ANALYSIS System through the 110-bps secondary channel, which operates independently below the primary data channel bandwidth.

The DMC monitors the modem and communications link performance and sets an alarm whenever that performance falls below established limits. The DMC is polled at regular intervals by ANALYSIS and reports any alarm set since the last poll. When operation is normal, only poll acknowledgment is returned by the modem.

The DMC permits ANALYSIS to direct the modem to perform diagnostic tests or to change the mode of operation by remote control of modem software strapping.

When the MUX Feature is installed in the MPX 4800 or MPX 9600 modem, ANALYSIS can control the MUX configuration and command diagnostic tests by port.

#### DMC Installation

the DMC contains all the necessary circuits to interface with the 110-bps secondary channel (on the modem card), the modem strap loader, and the optional MUX card.

Connection of the DMC to the modem and MUX cards is accomplished through two 60-pin connectors mounted on the left side of the card. The ANALYSIS interface 25-pin connector is mounted on the rear of the card.

The front panel contains a message push-button control and indicator to send a signal to, or to receive a signal from, the ANALYSIS operator. The front panel also contains indicators for the secondary channel interface, alarm, and DMC control functions.

- If field installed, refer to Chapter 2 for installation procedures. Installation of the DMC card requires either the 2-card or the 3-card installation kit.
- Refer to the DMC hardware strap instructions and perform any required wire strapping.

**CAUTION:** For DMC card 866-6603-81xx, any voltage over 22 volts will destroy the EEPROMS. EEPROM type 2817 and EEPROM type 2817A operate on different dc voltages and cannot be mixed on the same circuit card. Straps must be in their proper position to prevent destruction of the devices.

For DMC card 866-6603-81xx (formerly 866-6603-5161) only, first locate EEPROMs U14, U15, U16, and U17 and wire straps CC/H, M/K, T/N, and W/V; then check the EEPROM type to ensure that the straps are in the correct position. Positions H, K, N, and V correspond to EEPROM type 2817. Positions CC, M, T, and W correspond to type 2817A.

**NOTE:** DMC card 866-6603-83xx and subsequent cards use only the 2817A EEPROM; therefore, the 21 VDC is supplied.

DMC Interface – A 25-pin female connector, mounted on the rear edge of the DMC, provides interfacing with ANALYSIS. This connector also is used to connect the secondary channel for those modems operating in tail circuits.

The optional DCAA connects to the DMC via a 26-pin flat cable. The same cable is used whether the DCAA is internal or external.

## DMC Strapping

Strap selection depends upon the equipment installed and network configuration. The strap that is considered most probable is selected as the program default (off) setting.

The following straps are mandatory for DMC operation:

- Enable Secondary Channel
- Enable DMC Control of Analog Loopback
- DMC Address (Four Hexadecimal Digits)
- Modem Model Type (MPX 2400, MPX 4800, or MPX 9600)
- Master or Remote (Slave) Configuration
- Line Configuration (Multipoint or Point-to-Point)

## DMC-Controlled Modem Strapping

Certain MPX modem straps can be controlled by ANALYSIS through DMC. These straps are altered two ways:

- During an ANALYSIS-invoked test, straps are stored temporarily. Entering the strap loader mode during this test will store these straps permanently
- The network operator may modify permanently all the straps shown on the ANALSYS controller screen.

The modem straps may be changed by the DMC.

## DMC Controls and Indicators

Controls and indicators for the DMC consist of one push-button and eight LED indicators and shown and discussed below:

CALL	Push-button, self-latching. Press to signal the ANALSYS operator or to activate the message alarm at the ANALYSIS console. CALL must be disengaged to clear the message alarm.
MSG	Indicator, yellow. MESSAGE. Lights when the ANALYSIS operator has a message for the modem operator.

illumination. The ON LINE, FF, VERNIER, and LF buttons are used to align the paper with the print head. The buttons labeled TEST, 1, 2, and 3 are used in maintenance procedures. Power should remain applied to the RFSP except for unusual circumstances.

2.10.7.9 The operator may be required to perform some maintenance such as print head/forms alignment, forms replacement, or ribbon cartridge replacement. The procedures for print head/forms alignment and ribbon and cartridge replacement are located in section 3 of the FLIGHT STRIP PRINTER OPERATORS MANUAL (M2501010-9C00).

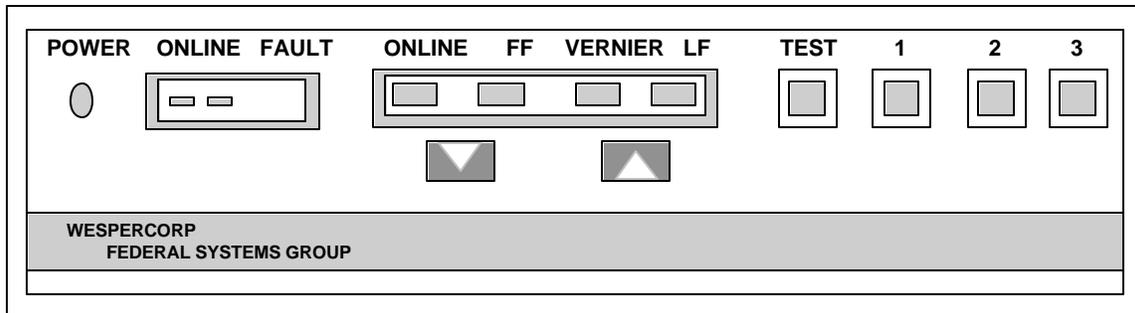


Fig 2-3: RFSP FRONT PANEL

### Cathode Ray Tube Display (CRT)

2.10.7.10 The CRT provides the user with a temporary display of data provided to the FDS II system. Under normal conditions, the CRT is fully independent and does not require direct user control.

2.10.7.11 A power switch is located on the lower left front of the unit. When powered on, the display will perform an internal self test and initialize itself for proper operation. Power should remain applied to the CRT except for unusual circumstances.

2.10.7.12 After initial power on, the CRT should display a "blinking" cursor in the lower part of the display area. A series of equal signs ("=") is used to divide the screen into the message composition area and the message display area (fig 2-4).

2.10.7.13 The composition area is the area below the line of equal signs. This area is again divided into two sections, but no dividing indicator is displayed. The lower portion of this area displays the inputs received from the RANK. The upper portion of the composition area is used to display message status reports, such as accept or error responses received from the ARTCC.

2.10.7.14 The large, upper area or message area is used to display control data messages such as flight strips, flight data amendments, and test device messages.

2.10.7.15 The messages in this upper area are duplicates of the messages received and printed by the RFSP.

2.10.7.16 The message area employs a scrolling feature to provide the user with a presentation of a message as soon as it is received. The next message received is displayed without the user having to take any action to view it. This process is explained in the following steps and illustrations.

Example 1. The first message is received and displayed at the bottom of the message area.

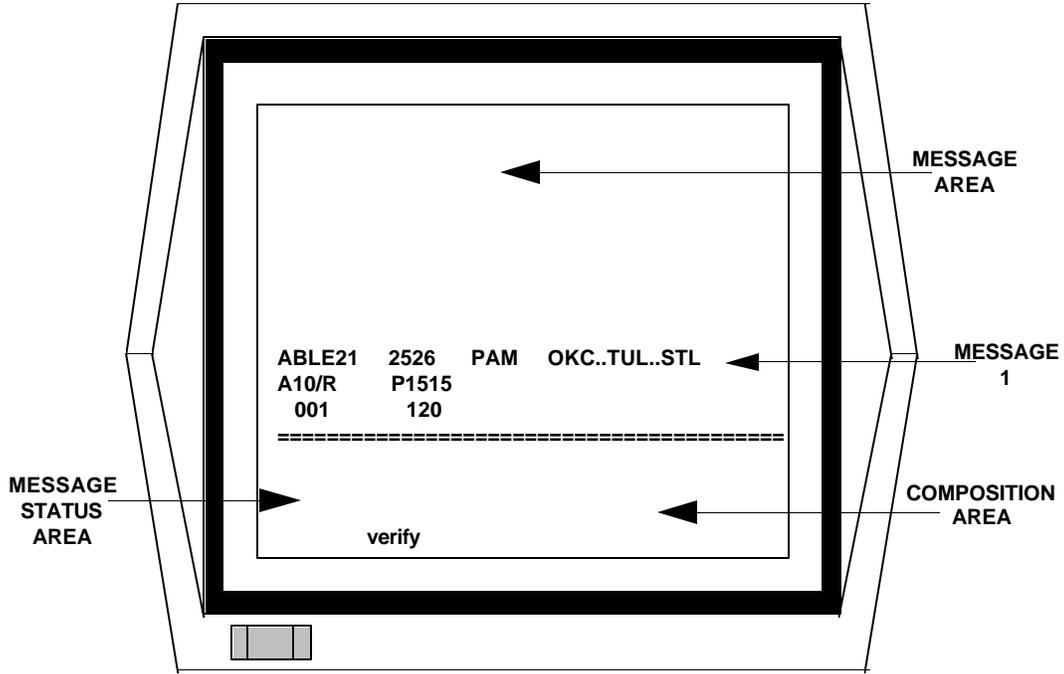


Fig 2-4: CRT DISPLAY AREAS (WITH ONE FLIGHT PLAN)

Example 2. When the fourth message is received, the first message is now deleted and is no longer displayed. The second and third messages are scrolled upwards while the fourth is now displayed in the bottom of the message area. As more messages are received, the top message will be deleted and subsequent messages will be scrolled upwards for display.

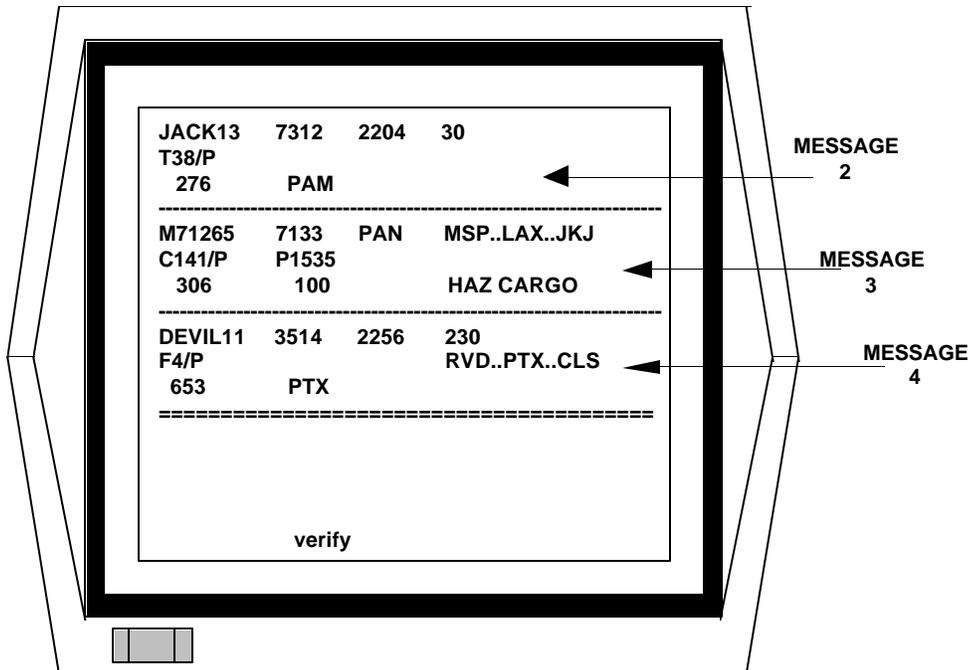


Fig 2-5: CRT DISPLAY (WITH FOUR FLIGHT PLANS)

**NOTE: The number of messages displayed on the CRT at any one time may vary due to the size of messages received.**

2.10.7.17 FDS II is designed to operate while holding a continuous link with the ARTCC NAS computer for uninterrupted data transfers and requests. In the event that the data link is interrupted (off-line), the controllers will be alerted by a system off-line message sent to all CRT's. This message will remain on all CRT's until the data link is reestablished. Also, while the off-line message is being displayed, FDS II is trying to correct the problem and reconnect with NAS. Once FDS II reconnects with NAS (on-line), normal system operations resume.

## 3. Installing the FDS II Software

### 3.1 Installing the Software Using the Bootable Disk

#### 3.1.1 Floppy Disks

3.1.1.1 Floppy disks can be damaged easily. Observe the following precautions when handling them.

**DO:**

- Format all new disks.
- Store them in their protective envelopes.
- Keep them clean and dry.
- Make backup copies of valuable disks.
- Put write-protect tabs on valuable disks.
- Label them with stick-on labels using a felt-tip pen.
- Remove disks before turning the computer off.
- Keep disks away from heat, direct sunlight, and magnets.

**DON'T:**

- Reformat valuable disks.
- Use ballpoint pens or pencils when writing on the labels.
- Expose them to magnetism of any sort.
- Touch the exposed surface of the disk.
- Use paper clips on them.
- Leave them in the disk drive when powering up.

#### 3.1.2 Formatting Floppy Disks

3.1.2.1 When formatting floppy disks using the Z-248 Platform, use low density 5 ¼" floppy disks for the Zenith Z-248 platform. Most of the time, these systems have low density floppy drives anyway. In case it does not, low density formatted floppies will work on Zenith Z-248s that have high density floppy drives.

**NOTE:** a formatted high density disk will not work on low density floppy drives!

3.1.2.2 In case you don't have any low density 5 ¼" floppy disks, you may format high density floppies as low density. This is done by formatting them in low density drives. So long as these disks are being formatted, it does not matter whether the floppy drives are high density or not.

3.1.2.3 Two things to remember when formatting HIGH DENSITY floppies:

1. formatting HIGH density floppies in low density drives will produce low density floppies.
2. formatting HIGH density floppies in high density drives will produce high density floppies.

#### 3.1.3 What's a Bootable Disk?

A bootable disk is a 5 ¼" DOS bootable floppy disk containing the following files:

COMMAND.COM -- acquired by formatting this disk with "/s" option—this and 2 hidden files make's it 'bootable'

AUTOEXEC.BAT – the batch files that automatically loads FDS by running the file, RCU.EXE

NOBOOT.COM – this files makes is impossible to re-boot the system by doing a CTL-ALT-DELETE.

RCU.EXE – the file that actually runs FDS.

This disk is inserted in the boot floppy drive (usually drive A) just before the computer is powered on.

### 3.1.4 What's a System Disk?

A non-bootable disk containing everything like a bootable disk except it doesn't NOT have command.com and it's 2 hidden files. It simply has the following files:

AUTOEXEC.BAT  
NOBOOT.COM  
RCU.EXE

The purpose of this diskette is simply for BACK UP. In case something happens to the Bootable Disk, e.g., gets lost, gets bad, etc., this disk will be able to provide the necessary files to recreate another bootable disk. In this case, a floppy disk will need to be formatted with the '/s' option, e.g., FORMAT A: /S. Once the DOS 'system' is 'transferred' unto the disk, then the files from the SYSTEM DISK are copied over to the new BOOTABLE DISK.

### 3.1.5 What's the MS-DOS 3.21 Disk Set?

The MS-DOS 3.21 Disk set contains both your system's operating system (DOS) and many supporting files (miscellaneous utilities). This set makes it possible to do certain tasks, such as organize the disk (with the FORMAT command), copy information from one disk to another (with the COPY command), enter date and time (DATE and TIME commands), and load the operating system itself to your Z248 system. These disks are titled: Distribution Disk 1 and Distribution Disk 2. This disk also contains the SETUP program (not to be confused with the CMOS Setup program). SETUP is a menu driven utility that can be used to make working copies of your MS-DOS distribution disks. These are disks that contain system files so you can boot up from the disk without loading MS-DOS separately.

## ***INSTALLING THE SOFTWARE***

While the Z-248 is powered off, insert the diskette containing the current version of the FDS II software into floppy diskette drive A and close the drive door. To apply power, flip the power switch located on the right side of the rear panel of the Z-248 to the on position. The light on the disk drive should illuminate as the computer reads the disk and loads the FDS II program into memory. During initialization, the software will construct a configuration file if one is not already present. This auto-construct file is adequate for system operation but may be changed by the user after system initialization. Once the initialization routine is finalized, the system is operational and ready to perform flight data operations.

### Step by Step and What Happens Along the Way!

1. Insert the FDS II Bootable disk into the boot floppy drive of your FDS II computer and close the drive door.

2. The computer should already be set up to boot off of that Bootable disk, running FDS II software automatically.
3. During initialization, any peripheral, e.g., Rank, CRT, and/or RFSP should also automatically initialize.
  - a. the CRT screen initializes by creating a composition area and the message area divided from each other by a fixed horizontal line making up of 80 equal signs.
  - b. the RFSP initializes by sounding a brief alarm.
  - c. the RANK simply is powered on and after the FDS software is loaded, ensure that the characters pressed on the keyboard also appear on the CRT behind it.
4. After initialization is completed, the main menu should appear. Press F2 to show Reconfiguration menu, double checking on the device assignment and pairing.
5. If everything goes smoothly, i.e., FDS properly loaded and peripherals properly initialized, send CANNED messages from the FDS computer's Diagnostic menu to the CRT(s) and to the RFSP. Below is how it's done:
  - a. from the Diagnostic menu, send a canned message to all configured RFSPs and CRTs.
  - b. The RFSPs should print the canned message(s) and the CRT's should display the canned message(s), too.

**NOTE: Under no circumstances should the disk drive door be opened while the system is accessing the diskette. This could result in the destruction of one or more of the FDS II program files.**

The Z-248 should **not** normally be shut down. In a very rare case where shutdown is necessary, or a software version change is required, the primary concern is with FDS II software protection. Insure that the red light on disk drive A: is off. Then, and only then, open the drive latch. After this is done the Z-248 must be turned off by flipping the power switch to the off position. In no case should the drive latch be closed again until after the computer has been powered down.

The Z-248 displays FDS II error messages, along with the date and time of the errors, system status information, and displays prompts and responses from the Reconfiguration, Diagnostics, and Error History tasks. Error messages are also logged to an error logger device if one is assigned. The error logger device can be either an RFSP or a printer, if one is available. Operational air traffic control flight data messages cannot be entered through the Z-248 system.

SETUP will also set up your Hard Disk partition. It will format the partition, transfer the system files, set up BIN (subdirectory), transfer the utility files to the subdirectory and establish a path to it.

## 3.2 Overall Computer System Operation

Each FDS II will be installed by Electronic Installation (EI) personnel. All equipment will be thoroughly checked out and certified operational before the system is brought on-line.

All FDS II sites are thoroughly tested before installation is complete. When FDS II is integrated for operations, initial startup will be performed by trained technicians.

### **WARNING**

**Shutdown of the FDS II equipment may cause a threat to air safety. For this reason, it is recommended that shutdown due to any condition other than an emergency be coordinated through ARTCC management.**

Individual peripheral devices may be taken off-line for maintenance without system interruption. When this occurs, a previously designated backup will replace the device.

There are minimal operator control adjustments on the FDS II equipment. At power up, the user must insure that all peripheral equipment is on-line and ready for operation. In general, peripheral devices should remain powered on. If a peripheral device is powered off, the Z-248 will not attempt to communicate with it.

### **FDS II Startup Procedures**

While the Z-248 is powered off, insert the diskette containing the current version of the FDS II software into floppy diskette drive A and close the drive door. To apply power, flip the power switch located on the right side of the rear panel of the Z-248 to the on position. The light on the disk drive should illuminate as the computer reads the disk and loads the FDS II program into memory. During initialization, the software will construct a configuration file if one is not already present. This auto-construct file is adequate for system operation but may be changed by the user after system initialization. Once the initialization routine is finalized, the system is operational and ready to perform flight data operations.

**NOTE: Under no circumstances should the disk drive door be opened while the system is accessing the diskette. This could result in the destruction of one or more of the FDS II program files.**

### **FDS II Version Change And System Shutdown**

The Z-248 should not normally be shut down. In a very rare case where shutdown is necessary, or a software version change is required, the primary concern is with FDS II software protection. Insure that the red light on disk drive A: is off. Then, and only then, open the drive latch. After this is done the Z-248 must be turned off by flipping the power switch to the off position. In no case should the drive latch be closed again until after the computer has been powered down. In the case of a software version change, continue with FDS II startup procedures as outlined in 3.1.1.2.

### **FDS II State Of Operation**

FDS II is designed to operate while holding a continuous link with the ARTCC NAS computer for uninterrupted data transfers and requests. In the event that the data link is interrupted (off-line), the controllers will be alerted by a system off-line message sent to all CRT's. This message will remain on all CRT's until the data link is reestablished. Also, while the off-line message is being displayed, FDS II is trying to correct the problem and reconnect with NAS. Once FDS II reconnects with NAS (on-line), normal system operations resume.

## **Z-248 SYSTEM OPERATING PROCEDURES**

The Z-248 displays FDS II error messages, along with the date and time of the errors, system status information, and displays prompts and responses from the Reconfiguration, Diagnostics, and Error History tasks. Error messages are also logged to an error logger device if one is assigned. The error logger device can be either an RFSP or a printer, if one is available. Operational air traffic control flight data messages cannot be entered through the Z-248 system.

### **Input**

The FDS II system receives input from the NAS computer located in the FAA ARTCC and prepares the information prior to output to the peripheral devices.

### **Z-248 Keyboard**

The Z-248 keyboard is either the standard 84 key or the enhanced 101 key keyboard. The keyboard allows the technician to communicate with the Z-248 computer during operational tasks and to display or clear error messages. Also, through Z-248 keyboard entries, the system allows modification of overall system parameters and device interaction.

### **Output**

The Z-248 relays information received from the NAS computer to the FDS II peripherals for display and/or printout. System and device error status, as well as a history of errors, can be displayed or printed to a selected output device.

### **Z-248 Display**

The Z-248 computer display remains on during FDS II operation to display the 10 most recent error messages. FDS II is completely menu driven and is waiting for an allowable keypress as displayed on the Main Menu.

### **Alps Printer**

If an ALPS P2000G printer is installed with FDS II, it may be used for recording the system error history and for logging system and device errors.

## **PERIPHERAL EQUIPMENT OPERATING PROCEDURES**

### **Input**

The FDS II accepts input from two sources: the Z-248 and the replacement alphanumeric keyboard (RANK).

### **RANK**

The RANK is the input device for flight plan data and message entry for relay to the ARTCC host NAS computer. The RANK is designed for composing and editing messages and is divided into two basic sections identified by color. The white section has a standard typewriter setup and is used for message entry while the blue section contains some special keys for message editing. Refer to section 2.2.1.1, figures 2-1 and 2-2 for keyboard layout, and to section 2.6.1 for special key definitions.

When power is applied to the RANK, the keys will illuminate. A control knob located on the upper right side of the top panel is used to control keyboard illumination. Turn the knob counter clockwise to decrease and clockwise to increase the brightness.

There are sixteen message types that may be generated on the FDS II at the RANK. Refer to section 2.5 for message types and formats. Messages entered at the RANK will be verified for proper message format before transmission to the ARTCC host NAS computer if the RANK is in verify mode. The VERIFY key, located in the blue control section of the keyboard toggles the verify mode, which is initially configured on. If a message format error is found, an error message is displayed at the RANK's paired unit. If a RANK is not functioning correctly, or the NAS computer reports that it is not

transmitting, a technician is notified to find and correct the problem. This report is only received at the NAS.

### **Output**

FDS II is designed to accept, process, and log flight data input and general information messages to the ARTCC host NAS computer and to output data as necessary to a CRT or RFSP.

### **CRT**

The CRT is used to display messages exchanged with the ARTCC host NAS computer. Under normal conditions, the CRT is fully independent and does not require controller operation. The CRT is paired to a RANK and is used as a backup to display flight strips. The screen will be divided into two horizontal display areas by a series of 80 equal signs ("="). The areas are:

- a. Flight Strips - incoming flight data and general information messages from the ARTCC host NAS computer.
- b. Composition Area - for visual display of messages composed on the paired RANK.

### **RFSP**

RFSPs print flight strip data, pertinent flight information for the controllers, composed FDS II messages, and error messages. The RFSP has a green LED power indicator to signal power on. Additional lamps on the front control panel include ON-LINE and FAULT. The ON-LINE LED indicates that the printer is available for communication with its paired RANK or the ARTCC host NAS computer. The FAULT LED blinks in conjunction with an audible warning to signal a condition requiring operator attention. See section 2 of the FLIGHT STRIP PRINTER OPERATORS MANUAL (M2501010-9C00) for display of RFSP controls and indicators.

#### **Top of Form Adjustment**

If the flight strip paper is out of alignment with the print head, the following steps will reset the top of form:

- a. toggle the printer off-line.
- b. press form feed to register top of form.
- c. press the line feed and vernier simultaneously to adjust the flight strip downward until the paper perforation is aligned with the tear bar on the RFSP.
- d. press the ON-LINE button.

The RFSP will bring the form down to the print line and print the first flight strip as sent by the ARTCC host NAS computer. The printer may be taken off-line to fine adjust the print line using the vernier enable and line feed or form feed button, if necessary. RFSPs will automatically form feed at the beginning of each message printed. Also, a momentary alarm will sound if the RFSP needs operator attention. For RFSP paper loading procedures and ribbon cassette replacement see section 3 of the FLIGHT STRIP PRINTER OPERATORS MANUAL (M2501010-9C00).

### **Port Assignment**

Peripherals such as the CRT, RANK, etc. are logically connected to the FDS II system via ports on the OC-8000 circuit board. The port assignment selection allows for proper hardware configuration during initial installation or for changes that may become necessary in the event of hardware port failure or desired system configuration changes. Port assignment should not normally be changed except by maintenance personnel.

## **PERIPHERAL PAIRING**

The purpose of pairing peripherals together is to provide an echo device for a desired peripheral.

### **RANK Pairing**

RANK pairing permits the user to assign a specific replacement flight strip printer (RFSP) or cathode ray tube (CRT) as the output device for a specific RANK, and to specify which RFSP will be the alternate output device (pair alternate) for the pair. The alternate output device for a RANK paired with a CRT is always an RFSP. From the Main Menu press the function key <F2> for the Reconfiguration Menu, then the <F3> key to arrive at the RANK Pairing Menu. From the RANK Pairing Menu select the device number of the RANK you want to pair up, and input the device number of the RFSP or CRT you want to pair it with.

### **RFSP Pairing**

RFSP pairing is to provide a link between a RFSP and a CRT. To get to the RFSP Pairing Menu, depress the <F7> key while in the Reconfiguration Menu. When the RFSP Pairing Menu appears on the system console, select the desired RFSP and the CRT it is to be paired with.

## **STRIP SIZING**

By depressing the <F9> key while in the Reconfiguration Menu, the user will be presented with the RFSP Strip Size Menu. This allows the user to select the size of the flight strip to be used. The user must choose the device number of the corresponding RFSP and select <F2> for full flight strips (FAA Form 7230-19, 7230-7.1, FAA Form 7230-8) or <F4> for half size flight strips (FAA Form 7230-7.2). The default is full size flight strips. After this selection is made the Current Configuration window will reflect this change.

## **ERROR LOGGER**

The user may assign a RFSP or a printer, if one is connected to the Z-248, to be the error logger for the Z-248. From the Main Menu press the function key <F2> for the Reconfiguration Menu. Next press the <F5> key for the Error Logger Menu. Then the <F2> key to select "line printer" or <F4> to select a RFSP. If <F2> is pressed, a message will appear warning the user that if a line printer is selected as error logger, one must be connected or the system may lock up if an attempt to write is made to a non-existent printer. If <F4> is pressed, the user will be asked for the device number corresponding to the RFSP that is to become the Error Logger. After either choice is made, a prompt is displayed requesting validation of your intent. Press "Y" to complete the error logger assignment or "N" to exit the menu without making any changes.

## **ERROR HISTORY**

The error history function provides the user with a list of system errors as well as device errors. System errors are those which impact the system as a whole and are usually software or functionally oriented. Device errors are those errors which relate to a particular peripheral or system component and are normally mechanically oriented.

The error list, when chosen by the user from the main menu, can be displayed on the Z-248 monitor or printed to a selected error logger device. The user should view this list prudently since it may contain errors that date to system start-up. Procedures to purge the list of outdated errors are available. Again, since the list is historical and since all errors listed may not be fatal to the system, common sense should be used when interpreting this list.

## **ERROR MESSAGES**

The FDS II software system has diagnostic tests and error messages to aid the user in determining whether problems exist within the system.

From the Error History Menu, a history of system errors or device errors can be listed to the system console or printed to the selected output device.

### **Peripheral Device Error Messages**

- |         |    |   |   |
|---------|----|---|---|
| Error # | 4  | - | DEVICE NOT READY  |
|         |    |   | Self explanatory. Notify maintenance if this is frequently encountered on the same device.  |
| Error # | 6  | - | PRINTER OUT OF PAPER  |
|         |    |   | Self explanatory. For RFSP paper loading procedures see section 3 of the FLIGHT STRIP PRINTER OPERATORS MANUAL (M2501010-9C00).   |
| Error # | 61 | - | RCU EEPROM FAILURE  |
|         |    |   | A Z-248 disk error has occurred. Notify maintenance.  |
| Error # | 62 | - | DEVICE NOT PRESENT  |
|         |    |   | Self explanatory. Notify maintenance.   |
| Error # | 63 | - | ILLEGAL PERIPHERAL CONNECTED  |
|         |    |   | Self explanatory. Notify maintenance.   |
| Error # | 64 | - | PERIPHERAL IS NOT READY   |
|         |    |   | Normally this signifies that the device is busy. This isn't normally a problem unless it occurs frequently with the same peripheral. In that case maintenance should be notified. |
| Error # | 66 | - | PERIPHERAL IS OFF LINE  |
|         |    |   | Self explanatory. Put peripheral on line.   |
| Error # | 67 | - | DEVICE FAULT  |
|         |    |   | A non-specific fault has occurred in one of the devices. Notify maintenance.  |

**System Error Messages**

- Error # 2 - RCU LAN FAILURE  
Indicates a failure from all UARTs on the OC-8000 Stargate remote board. Notify maintenance.
- Error # 7,8- UNABLE TO TRANSLATE MESSAGE  
Possible causes might be illegal input sent or an invalid message type being sent. Notify maintenance if this is frequently encountered.
- Error # 18 - BUS CONNECTOR FAILURE  
Indicates the failure of an OC-8000 Stargate remote board. Notify maintenance.
- Error # 46 - MODEM TRANSMITTER FAILED  
Self explanatory. Notify maintenance.
- Error # 47 - MODEM RECEIVER FAILED  
Self explanatory. Notify maintenance.
- Error # 65 - PARITY ERROR ENCOUNTERED  
An error was encountered on an incoming message. Notify maintenance if this is frequently encountered.
- Error # 69 - INVALID CONFIGURATION  
FDS II is incorrectly configured for the hardware available. Notify maintenance.
- Error # 74 - WARNING: FP DISABLED VIA NAS. Recommend landline communications with ARTCC. They have disabled the FDS II system.
- Error # 75 - WARNING: FP ENABLED VIA NAS. No action necessary, ARTCC has enabled the FDS II to operation.

**INTERNAL DIAGNOSTICS**

The FDS II software has the ability to perform limited system diagnostics. By utilizing the diagnostic functions, the user may cause the system to perform the following criterion.

- a. Check a peripheral's operability by sending a canned test message to a selected peripheral.
- b. Determine the status and identity of a peripheral connected to a specified port.
- c. Unlock an RFSP attached to the maintenance channel so that checks and alignments may be performed on the printer.
- d. Send a series of characters to a CRT attached to the maintenance channel so that the CRT may be aligned.

These functions may be used during system operation with minimal effects to ATC operations. However, common sense should dictate since delays to ATC messages may result.

### RECOVERY PROCEDURES

If the system operation is for some reason interrupted, follow the shutdown and startup procedures as outlined earlier. The FDS II will, normally, automatically recover from a power failure/interruption as long as the program diskette is left in drive A: with the drive latch down.

## 3.3 Testing the Peripherals You've Connected

PASS / FAIL TEST 1: Powering Off the System – The power failure recovery feature will automatically boot and reinitialize the FDS II peripherals after a power failure to the Z-248 computer.

- Using the power switch located on the rear panel of the Z-248 computer, change the switch to the “off” position. After approximately 30 seconds, return the power switch to the “on” position.
- RESULT: The Z-248 should automatically boot into operation, initialize the peripherals, and begin operation.

PASS / FAIL TEST 2: Disconnect the Modem.

- RESULT: After approximately 15 seconds all CRTs should display the off-line message. If a message was sent from the RANK during the offline condition but before the off-line message was displayed, FDS II will also display “MSG TIMED OUT, MSG RETAINED” or “NO NAS COMMUNICATIONS, MSG RETAINED”. Also the keyboard will be disabled.

PASS / FAIL TEST 3: Reconnect the Modem.

- RESULT: All CRTs will be reset to their pre-offline condition with the exception that verify will be on.

PASS / FAIL TEST 4: From the diagnostic menu, select a device and send a canned message to it.

- RESULT: The message should be output by the select device.

PASS / FAIL TEST 5: From the diagnostic menu, select a device that is available for use and request status.

- RESULT: A message describing the device and its operational status should be displayed.

PASS / FAIL TEST 6: Disconnect a device and using the same menu above, resend the status check.

- RESULT: A message describing the device and indicating the device is not operational should be displayed.

## 4. Periodic Maintenance Tips

## 4.1 Suggested Performance Checks

---

### 4.1.1 Monitor/CRT

#### *Things to check daily:*

1. Observe the correct indication of the System Monitor for correction operational indications. Is it the right program? If so, is it the right revision level of the software currently used in the system?
2. Is the Monitor's contrast button working? Turn control button clockwise and counter clockwise and observe changes in contrast and set at desired level.
3. Is the Monitor's brightness button working? Turn control button clockwise and counter clockwise and observe changes in brightness and set a desired level.

---

### 4.1.2 CPU

#### *Things to check daily:*

1. Listen for unusual sounds within the CPU. Check to see if all visible light indicators on CPU panel are lit and NOT showing any signs of warnings or error signals. Be alert of electrical burn smell coming from the CPU and the rest of its peripherals. Avoid drinks and food on or nearby your Z248 system.
2. Are all CPU components working? Floppy drive latches working properly, Power light is working, surge suppresser switch working properly?, etc.
3. The FDS software should load off the FDS bootable floppy in the floppy drive, indicating the entire FDS main menu screen.

---

### 4.1.3 RANK

#### *Things to check daily:*

1. When power is applied, the RANK is illuminated, indicating that it's ready for use. Power should remain applied to the RANK except for unusual circumstances.
2. Is the brightness control knob working? Turn the knob counter- / clockwise to see if the brightness changes in intensity. If so, adjust to the right level.
3. See if all the keys are illuminated. If not, let your equipment custodian know.

---

### 4.1.4. RFSP

1. When power is applied, a green light should illuminate on the front panel.
2. An audible alarm should sound in conjunction with powering up.
3. All pertinent front panel buttons should work for putting RFSP on- and off-line, form feeding, line feeding and configuration.
4. At the beginning of each message, your RFSP should automatically form feed.

## 4.2 On-Site Maintenance Tasks

---

### 4.2.1 Monitor/CRT

#### Preventive Maintenance

1. At least once a week, wipe the monitor (or CRT) with an industry approved computer screen wipers (usually alcohol based). Do not use window cleaners or a wet rag.
2. Keep food and drink away from your monitor or CRT.
3. Keep monitor or CRT on a stable surface to prevent from falling and/or accidental disconnection.
4. Keep cabling and power cords secure and 'tucked' away from traffic.
5. If you have a backup Monitor or CRT, make sure it still works in case the current one goes bad.
6. Make sure all connections are secured.

---

### 4.2.2 CPU

#### Preventive Maintenance

1. Unless really necessary, DO NOT install a hard drive into your Z-248. FDS version 011 does not support it. This will result in FDS booting failure and system lock up.
2. If you already have a hard drive installed, 'disable' it in your Z-248's CMOS setup program, e.g., CTL-ALT-INS to invoke this program.
3. Keep food and drink away from your CPU.
4. Keep cabling and power cords secure and 'tucked' away from traffic.
5. If you have a backup CPU, make sure it still works in case the current one goes bad.
6. Make sure all connections are secured.

---

### 4.2.3 RANK

#### Preventive Maintenance

1. Keep food and drink away from your RANK
2. Keep cabling and power cords secure and 'tucked' away from traffic.
3. If you have a backup RANK, make sure it still works in case the current one goes bad.
4. Make sure all connections are secured.



## 4.2 On-Site Maintenance Tasks

### **Preventive Maintenance**

No special preventive maintenance is required to maintain the modem in good working order when it is operated in a location that is clean and free from extremes of temperature, humidity, and vibration.

The following preventive maintenance schedule is recommended if the modem is operated in any environmental extremes.

#### Quarterly Inspection

1. Inspect front panel switch movements for damage.
2. Inspect interface cables and power cord for cuts, cracks, chafing and/or other physical damage.
3. Turn on modem power and check that fan is operating normally and quietly. If fan is inoperative or excessively noisy or if air does not blow out through the side louvers, call service organization and schedule fan replacement.

#### Annual Inspection

1. Perform the quarterly inspection procedure.
2. Remove circuit cards and inspect for accumulation of dust or dirt.
3. If cards are dirty, clean them with a soft, long-bristled brush, (for example, a one-inch paintbrush).
4. Replace cards in their correct locations.
5. Plug in the AC power cord and perform the System Checkout Procedures to check that modem is operating properly.

## 5. Z248 System Overview

Your Z-248 PC is a flexible and very reliable system. It is designed by Zenith to provide you with years of trouble-free performance. The main part of your system is the Central Processing Unit (CPU). The CPU processes information, performs arithmetic functions, and provides control for the rest of the system. With a 200-watt power supply distributed through a ten-shot backplane board, the Z-248 can support many different option. The basic system includes disk storage, memory, videw, and input/output functions.

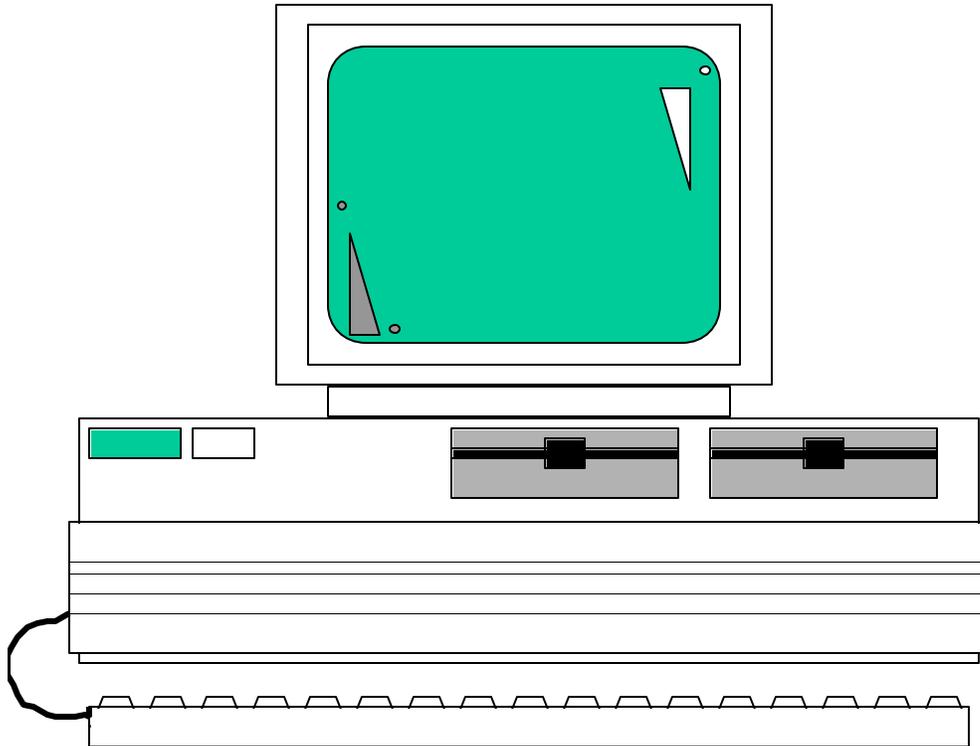


FIGURE 7. Z-200 PC Series Computer

The various part of the personal computer are described in the following pages.

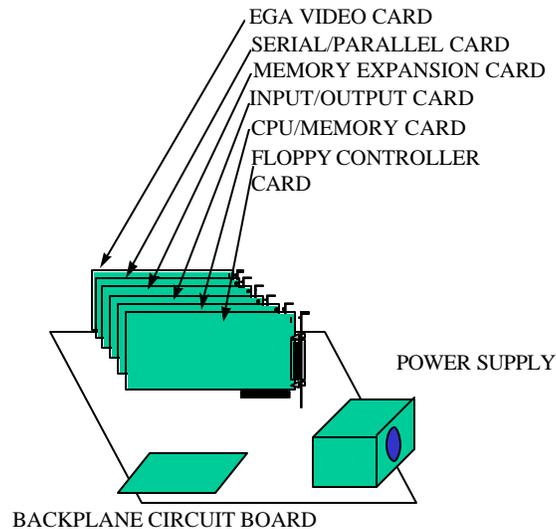


FIGURE 8. Hardware Configuration

## POWER SUPPLY

The switching mode power supply, located at the back right in the computer, provides 200 watts of power in a compact package. It can support many different peripherals including a tape backup system.

Do NOT attempt to service your power supply. It has no user-replaceable parts.

## BACKPLANE BOARD

The backplane is a board that acts as the computer's central nervous system. It is securely mounted to the computer chassis and has slots for ten cards. When a card is plugged into the backplane board, it becomes part of your computer.

The basic computer includes 5 cards: A Floppy/Winchester Controller Card, CPU/Memory Card, Input/Output (I/O) Card, Serial/Parallel Card, and a Video Card. Your computer also may include a Memory Expansion Card. The remaining slots on the backplane are for expansion such as an additional memory card and video cards.

There are also six Light-Emitting Diodes (LEDs) for monitoring the power supply.

A lithium battery is on the backplane board to provide power to the real-time clock when the main power is off.

## FLOPPY/WINCHESTER (Hard Disk) CONTROLLER CARD

The Floppy/Winchester Controller Card is capable of supporting up to two high performance Winchester disk drives and two floppy disk drives as well as the optional tape backup system.

## **CPU/Memory Card (General Info)**

The CPU/Memory Card contains an Intel 80286 Microprocessor and a socket is provided for an optional Intel 80287 Numeric Processor Extension. This card also contains: logic for generating the 16-bit bus control signals; buffering for address, data, and control buses; 512K bytes plus one parity bit per byte of RAM; parity generation and checking; 60K of ROM; and 4K of special scratchpad RAM.

## **Input/Output Card (I/O)**

The Input/Output Card contains the system control processor (Intel 8042), keyboard interface, speaker interface, parallel port, serial port, DMA controller, interval timer, interrupt controller, address decoding and generation of control signals for the expansion bus, and six LED indicators for diagnostic purposes.

The tone generator provides signals from 37 to 32,000 Hz for a speaker that is mounted on the card guide.

The parallel output port provides support for peripherals (usually printers) that require parallel signals.

The serial input/output port is RS-232 compatible and can be used with a number of different serial input/output devices. You could connect a serial printer, plotter, modem for asynchronous communications, or graphics tablet to this port.

## **Serial/Parallel Card (Comm. 3)**

The Serial/Parallel Card includes one serial and one parallel port for your computer system. This communications card also allows software emulation of the following terminals: IBM 3278, DEC VT-100, Honeywell VIP770SW, and Sperry UTS-40.

## **Video Card**

The Video Card is functionally compatible with the IBM PC Enhanced Graphics Adapter Card. It supplies signals for either a monochrome or enhanced color monitor.

## **Floppy / Winchester Controller Card**

Supports up to two high-density (1.2M) or standard density (360K) floppy disks and two Winchester disk systems.

### **MASS STORAGE**

Disks provide your computer with mass storage capability. Mass storage is important for several reasons which are explained in the following paragraphs.

Mass storage provides a place to store programs, data, and other information that needs to be kept for use some time in the future. Remember, information in RAM disappears each time the computer is turned off.

Mass storage also provides the computer with a place to store information that isn't being used at that very instant. For example, in word processing, long documents can reside on a disk and be moved to RAM as needed, where they can be edited quickly.

Mass storage is a reusable storage space. Once information is no longer needed, it may be erased and the space used for more current information. Floppy disks also provide a convenient method for transporting programs and data between computers.

## **CPU/Memory Card (more info)**

- \*\* 80286 microprocessor
- \*\* socket for 80287 numeric processor extension
- \*\* contains boot, monitor, and diagnostic programs in ROM
- \*\* system memory contains 512K of RAM

### **80286 Microprocessor**

The heart of your computer is the Intel 80286 Microprocessor. It consists of three sections -- an Arithmetic Logic Unit (ALU), memory, and a control section.

The ALU performs all of the calculations for the computer. The microprocessor's memory holds information which the ALU or the control section may use. This memory, while small, is the quickest in the machine. The control section keeps all of the information coming and going in the proper order, making sure that information arrives at the proper place at the proper time.

### **80287 Numeric Processor Extension**

On your CPU card there is a socket for an Intel 80287 Numeric Processor Extension. This device can, with the proper software, take over some of the arithmetic processing from the 80286 microprocessor and speed up the calculating of certain kinds of data.

Not all programs will benefit from the numeric processor extension. Only programs that are specifically meant for it will benefit from the 80287.

### **Read-Only Memory**

Read-Only Memory (ROM) retains the information stored in it even after the computer is turned off. It contains information which is vital to your computer's operation. The CPU/memory card has two ROM integrated circuits which contain:

1. power-up tests
2. SETUP (CMOS) program that stores the configuration information in the system
3. facilities that enable programmers to enter, examine, change, or run machine language programs
4. the boot, or bootstrap loader, program which enables your computer to load the operating system into system memory from disk
5. extensive menu-selectable diagnostics
6. video mode and scroll mode set commands, used to select the screen characteristics for the video display; and
7. device drivers for the devices that can be connected to the system.

### **Random Access Memory**

The smallest unit of information is called a bit. The next largest unit of information is a byte, which is composed of eight (8) bits. Each keystroke can be stored in one byte.

Random Access Memory (RAM) is used to temporarily store information, programs, and data, and to act as a work space for the CPU. Naturally, the larger the work space the more work that can be done.

## Input / Output Card (more info)

### Keyboard

The keyboard connector is located on the backplane board and extends through the back of the computer.

### Speaker

Your computer has a 2-inch speaker. GW-BASIC supports various tones and durations that enable your computer to play a full range of music. Consult the GW-BASIC manual for specific programming information.

### Parallel Printer Output Port

This parallel printer port is located on the I/O card. Its DB-25 connector is accessible through the rear panel of the computer.

The printer port is used to drive Centronics-type print devices (printers or plotters). This standard has been adopted by a large number of manufacturers.

Note that the port is brought out of the machine to a DB-25 connector rather than an edge connector. You must have the proper cable to use the DB-25 connector.

The operating system, MS-DOS version 3, is configured to use this port as a standard printer port as it is supplied by Zenith Data Systems. The table below defines the connections for the parallel printer.

Table H. PIN definitions for the Parallel Printer

Pin Number	Signal Name
1	Strobe
2	Data bit 0
3	Data bit 1
4	Data bit 2
5	Data bit 3
6	Data bit 4
7	Data bit 5
8	Data bit 6
9	Data bit 7
10	Acknowledgeable
11	Busy
12	Page end
13	Select
14	Auto feed
15	Error

- 16 Initialize printer
- 17 Select input
- 18-25 Ground

A typical parallel printer will be connected as shown in Figure 5.3. Be sure to use the proper cable.

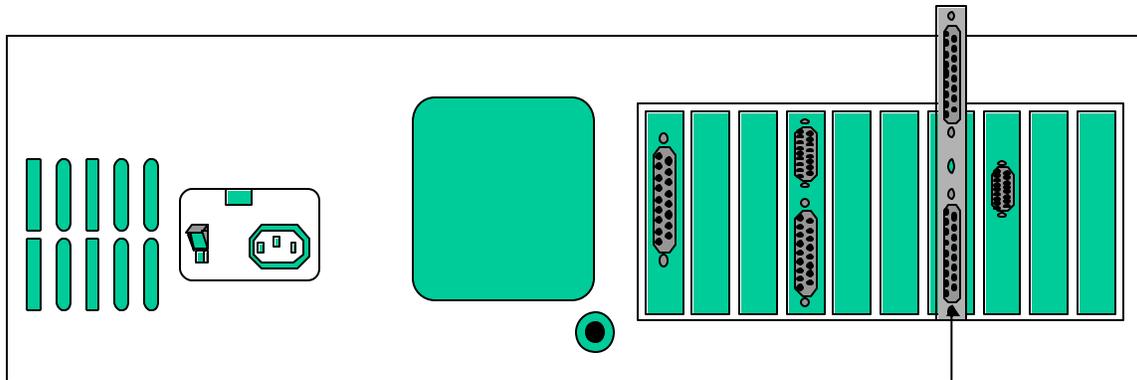


Figure 9. Parallel Printer Connection

**Parallel Printer**

**Connection**

Serial Printer Input/Output Port

Mounted on the I/O card is an RS-232 serial port that extends through the rear of the cabinet. The input/output port is software controlled and may be used with a wide variety of equipment, including serial printers, asynchronous modems, serial graphics devices, and even a “mouse.”

The serial port comes from the factory configured as RS-232 Data Terminal Equipment (DTE). The control signals are listed in the following table:

Table 10. PIN Definition (Control Signals) of the Serial Port

Pin Number	Signal Name
1	Carrier detect
2	Receive data
3	Transmit data
4	Data terminal ready
5	Ground
6	Data set ready
7	Request to send
8	Clear to send
9	Ring indicate

Connecting a Serial Printer

If you have a serial printer, connect one end of your cable to the DB-9 serial connector on the back of the computer and the other end to your printer. A special cable (such as the HCA-200-PC) is needed to connect a DB-25 output to this connector.

Before you can use the printer, you will have to run the configuration program (CONFIGUR) supplied with your operating system to properly configure the signals going to your printer.

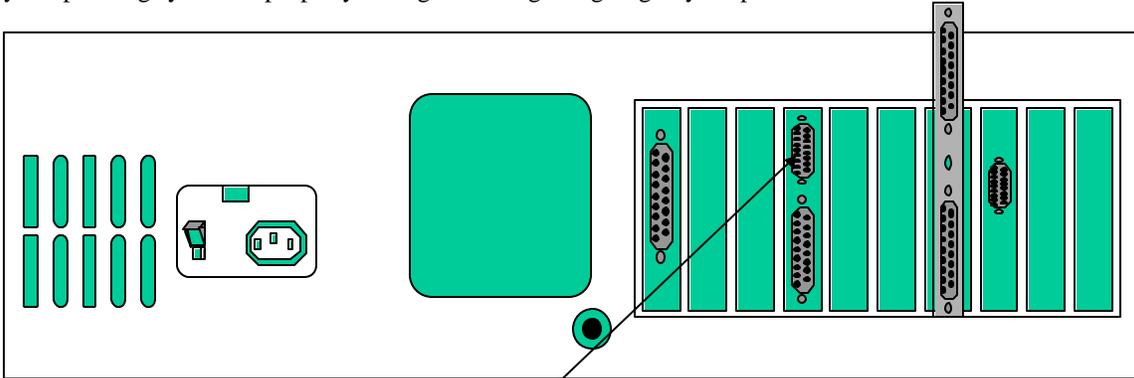


Figure 11. Serial Printer Connection

**Serial Printer Connection**

**Connecting a Modem**

There are two types of modems: acoustic-coupled and direct-connect. Both are attached to your computer the same way. However, the direct-connect also must be directly attached to your telephone line.

To attach your modem to your computer, plug one end of your modem cable into the serial connector on the back of your computer. Secure the other end to your modem.

**Modem Connection**

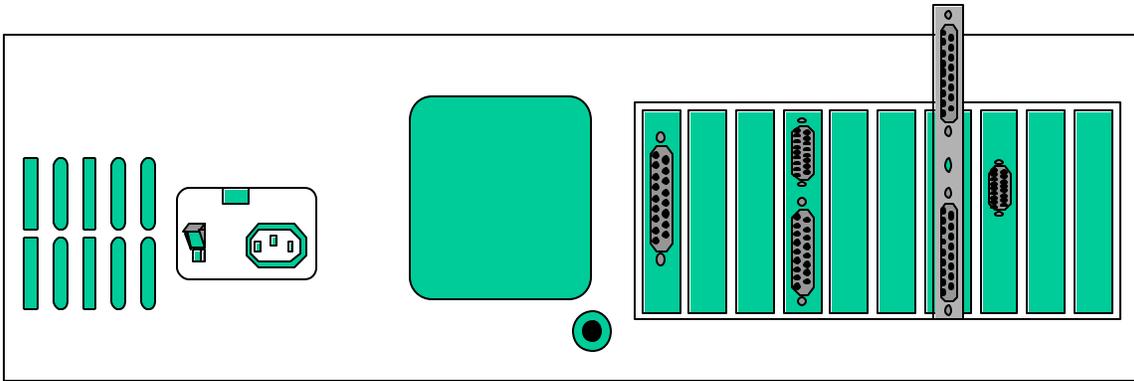


Figure 12. Modem Connection

### Serial/Parallel Card

The serial/parallel card is shipped preset for proper operation that includes jumper-selectable interrupt, and software-selectable duplex and baud rate. Unless notified, jumpers and switches should remain in the same position.

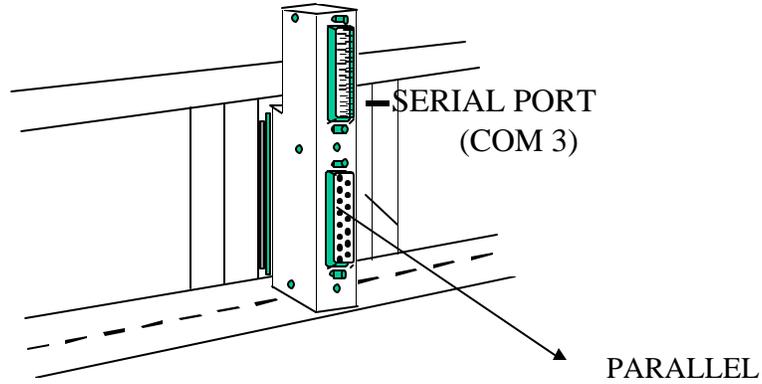


FIGURE 13. Parallel and Serial Connectors

Both the parallel and serial ports are located on the external breakout box mounted on the rear of the serial/parallel card, as shown in the figure above. The parallel port is the lower port on the breakout box and is a standard DB-25-pin connector.

Table J. Lower Parallel Port (DB25) Pin Definitions

SIGNAL	PIN NUMBER
Strobe	1

Data Bit 0	2
Data Bit 1	3
Data Bit 2	4
Data Bit 3	5
Data Bit 4	6
Data Bit 5	7
Data Bit 6	8
Data Bit 7	9
Acknowledge	10
Busy	11
P. End (out of paper)	12
Select	13
AutoFeed	14
Error	15
Initialize Printer	16
Select Input	17
Ground	18-25

The serial port is located on the top of the serial/parallel card's external breakout box. The port is a 25-pin RS-232 serial connector that is the software controller for a variety of communication applications. Serial pin definitions are define in the following table.

SIGNAL	PIN NUMBER
Not used	19
Not used	20
Transmit	21
Receive Data	22
Request to Send	23
Clear to Send	24
Data Set Ready	25
Not Used	26
Request to Send B	27
Clear to Send B	28
Select/Clear to Send C	29
Data Carrier Detect	30
Transmit Clock	31
Receive Clock	32
Data Terminal Ready	33
Ring Detect	34
Not Used	35
Not Used	36
Not Used	37

## Video Card

Depending on the model, your computer may have one or two types of video cards: an Enhanced Graphics adapter (EGA), or a multi-sync EGA video drive card. Refer to the Figure below, if your video card looks like either A or B then refer to the discussion under "EGA Video Card." If your video card looks like C then refer to the section titled "Multi-Sync EGA Card."

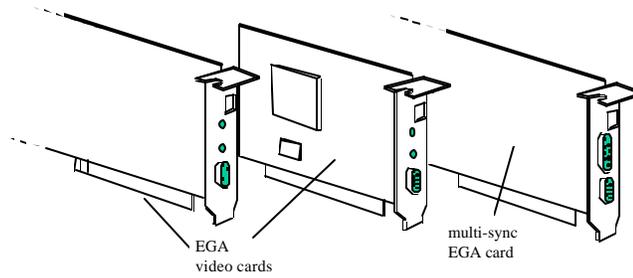


FIGURE 14. EGA VIDEO CARD

- 
- \*\* IBM PC Enhanced Graphics Adapter Compatible
  - \*\* Monochrome, enhanced color, or RGB color output
  - \*\* 40- or 80-character lines
  - \*\* Six available display modes

### Connecting the Monitor

Connect one end of the cable to the connector on the back of the computer. Connect the other end to the appropriate connector on the monitor.

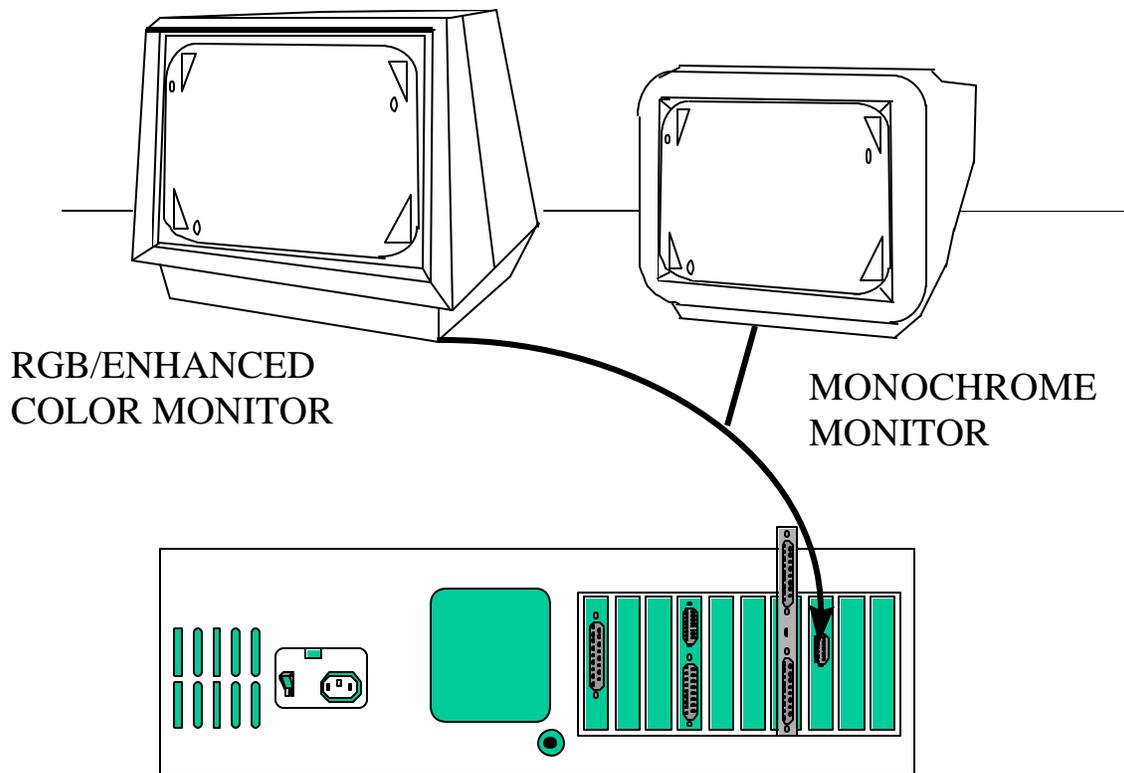


FIGURE 15. Monitor Connection

## Video Modes

Computers display information on video monitors in various ways, called modes. The resolution (sharpness) of the display varies from mode to mode, as does the number of characters per line and the ability to display colors.

Your EGA video card can display information in any one of six video modes with two possible cards. Compare your video card to the cards shown previously. Follow the switch settings for the card you have for the modes explained in the following Tables. The card has been set at the factory for use with an EGA-type monitor.

NOTE: The jumpers and switches on each card (shown in the figures) have been properly set at the factory and should not be moved.

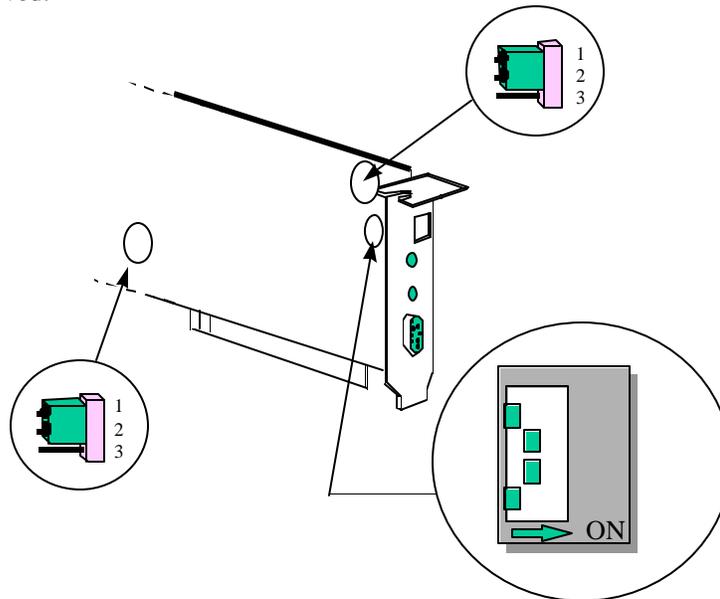


FIGURE 15a. Video Card Switch Settings

Table K1. Video Card Switch Position Descriptions

Switch Positions

1	2	3	4	Description
ON	OFF	OFF	ON	40 characters/line, 25 lines/screen, color.
OFF	OFF	OFF	ON	80 characters/line, 25 lines/screen, color.
ON	ON	ON	OFF	Enhanced display, emulation mode.
OFF	OFF	ON	OFF	* Enhanced display, high-resolution mode.
ON	OFF	ON	OFF	40 characters/line, 25 lines/screen, monochrome.
OFF	OFF	ON	OFF	80 characters/line, 25 lines/screen, monochrome.

\*Normal Factory Setting.

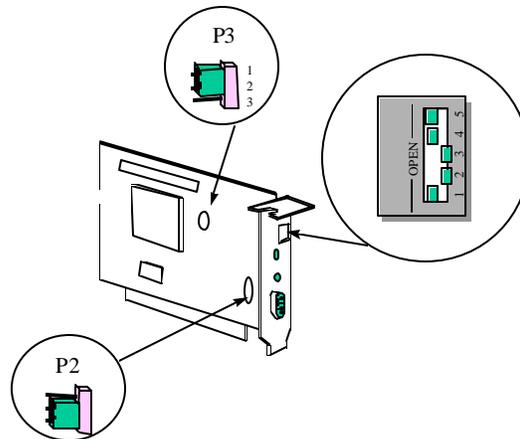


FIGURE 15b. Video Card Switch Settings (EGA)

Table K2.  
Switch Positions

1	2	3	4	5	Description
OFF	ON	ON	OFF	OFF	* Enhanced display, high resolution mode.
ON	ON	ON	OFF	OFF	Enhanced display, normal color mode.
OFF	OFF	OFF	ON	OFF	80 characters/line, 25 lines/screen, color.
ON	OFF	OFF	ON	OFF	40 characters/line, 25 lines/screen, color.
OFF	OFF	ON	OFF	OFF	80 characters/line, 25 lines/screen, monochrome.
ON	OFF	ON	OFF	OFF	40 characters/line, 25 lines/screen, monochrome.

\*Normal Factory Setting.

### Multi-Sync EGA Card

The video card is a multi-sync enhanced graphics video driver card. The card is able to detect and automatically implement the appropriate mode of operation:

- Color Graphics Adapter (CGA)
- Monochrome Display Adapter (MDA)
- Enhanced Graphics Adapter (EGA)
- Hercules Graphics Card (HGC)

The card can display:

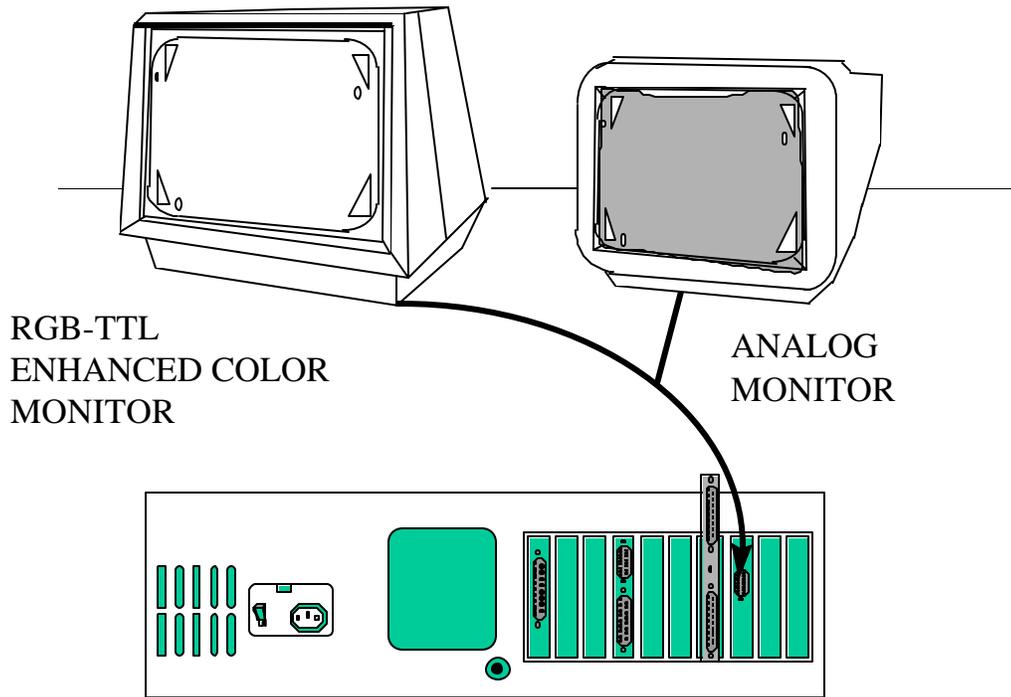
- Monochrome, enhanced color, or RGB color output
- 40- or 80-characters lines
- Five available display modes.

Usually any of the following types of monitors with this card:

- RGB-TTL monitors that operate at 15.75 kHz (CGA), 18.4 kHz (MDA, Hercules), and 21.85 kHz (EGA)
- Dual-frequency (15.75 kHz or 21.85 kHz) enhanced color
- Analog color and analog monochrome monitors that operate at 31.49 kHz

### Connecting an ANALOG Monitor

If it is an analog monitor connect one end of the cable to the 15-pin connector on the back of the computer. If it is an RGB-TTL monitor connect one end of the cable to the 9-pin connector on the back of the computer. See the Figure below. Connect the other end to the appropriate connector on the monitor.



### Video Modes

Computers display information on video monitors in various ways, called modes. The resolution (sharpness) or the display varies from mode to mode, as does the number of characters per line and the ability to display color.

Your video card can display information in any one of five video modes. The Card has been set at the factory for use with an EGA-type analog monitor. To connect a TTL EGA-type monitor to the card, change the position of switch to the native mode (ON).

The Table below describes the settings of the DIP (Dual Inline Package) switch, shown in the Figure below, used to select the video mode. You can access this switch through the rear panel.

Table K3

#### Switch Positions

1	2	3	4	Description
ON	OFF	OFF	ON	40 characters/line, 25 lines/screen, color.
OFF	OFF	OFF	ON	80 characters/line, 25 lines/screen, color.

ON	ON	ON	OFF	Enhanced display, emulation mode.
ON	OFF	OFF	ON	* Enhanced display, high-resolution mode.
OFF	OFF	ON	OFF	TTL monochrome display.

\*Normal Factory Setting.

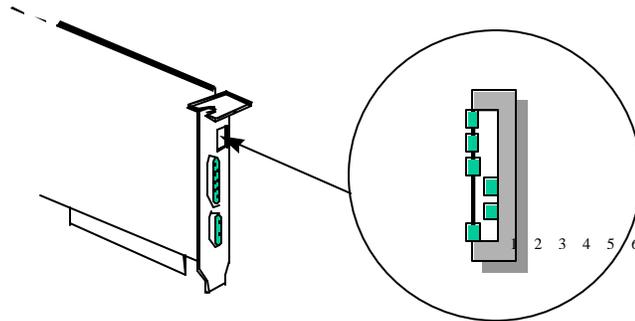


Figure 17. Video Card Switch Settings.

Switch section 5 enables or disables automode. Depending on the type of program you are running the video card can automatically switch modes. It can switch between CGA and EGA modes if you have an enhanced graphics color monitor or medium resolution color monitor attached. It can switch between HGC or EGA modes if you have a monochrome monitor attached. Setting switch section 5 off (factory setting) disables automode.

Switch section 6 selects the horizontal frequency required by the type of monitor you are using. Setting switch section 6 on (factory setting) selects 31 kHz mode (Z-mode). Setting switch section 6 off selects the native mode, used for monitors that operate at frequencies other than 31 kHz.

The video card display a 3- or 16-level gray scale' on a monochrome monitor and, for enhanced color monitors, the card (in an extended color graphics mode) can display up to 480 lines of resolution and up to 16 colors at a time from a selection of 256,000 colors.

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